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TOWARDS PURE FOOD

The centenary celebration in London of the 1860 Act for the Prevention of the Adulteration of Food on 20-23 September reflected great credit on all concerned in the arrangements, on the many benefactors (including several industrial firms) and on the public information services generally. It was a topic of universal interest and world-wide importance, in which the leadership of the United Kingdom, and the influence of chemistry, was manifest to all.

The 1860 Act resulted from a report by 'The Lancet Analytical Sanitary Committee' in 1855 under Dr A. H. Hassell, M.D., who became the first Vice-President of the Society of Public Analysts. This Act paved the way for the appointment of Public Analysts, which became compulsory under the Sale of Food and Drugs Act of 1875. Under the Public Analysts Regulations it has long been obligatory for a person seeking to become a Public Analyst to have passed the Institute's Branch E examination 'in the chemistry (including microscopy) of food, drugs and water,' first defined in 1896.

The celebrations included exhibitions at Charing Cross Underground Station, open until 8 October, and at the Royal Institution; sessions for the presentation of invited papers; and a social programme.

On the Friday evening a Banquet was held at Guildhall, where guests were received by Dr A. J. Amos (chairman of the Centenary Executive Committee) and Mrs Amos. The Toast of 'The Lord Mayor and the Corporation of London and the Sheriffs' was proposed by Mr E. LeQ. Herbert, President of the Institute (a Vice-President of Honour) to which Sir Edmund Stockdale replied. The Toast of 'The Pure Food Centenary' was proposed by the Rt Hon. Mr Christopher Soames, C.B.E., M.P., Minister of Agriculture, Fisheries and Food, to which Dr Amos responded. Mr J. P. Van den Bergh, C.B.E., proposed the Toast of 'Our Guests,' the response being made by Dr Norman C. Wright, C.B., Deputy Director-General, Food and Agriculture Organization of the United Nations.

Dr J. H. Hamence, President Elect of the Association of Public Analysts, opened the technical sessions with a historical introduction to the 1860 Act, and traced its influence on the purity of the world's food. Although at the time suitably qualified analysts were lacking, the first Public Analysts were enthusiastic chemists; they began a systematic study of the composition of foods and laid the foundations of modern methods of analysis.

The second paper, on the manufacturers' contribution to pure food, was given by Dr E. B. Hughes, chief chemist of J. Lyons & Co. Ltd. He said that the manufacturers' object was to produce wholesome food that appealed to the eye as well as the palate. The addition of small quantities of harmless additives, such as colours, emulsifiers, stabilizers and preservatives, is regulated by law. Scientific control ensures the purity, quality and uniformity of the products manufactured. Research on new and improved products, and the constituents and properties of food materials, is also undertaken by individual manufacturers and by research associations, through which small manufacturers have access to the same facilities as larger enterprises.

Dr J. G. Malloch, M.B.E., Scientific Adviser to the High Commissioner for Canada, spoke on 'Pure Food and the Commonwealth.' The British Act of 1860 was soon followed by legislation in other countries. Now, as new countries attain independence, there is no doubt that they will bring in pure food legislation, and may need help and friendly co-operation from more experienced nations. Conditions and customs are so diverse that each country must tackle the problem for itself. Foodstuffs are the largest single element in the economic life of the Commonwealth; intra-Commonwealth trade already amounts to £700 million annually, but there is a need to increase productivity, and to reduce the quantity of food spoilt before it can be eaten.

Dr Arthur Hill Hassall in 1855, from a portrait drawn at San Remo by T. W. Harland and now in the custody of the Institute

'International Aspects of Pure Food and Pure Food Legislation' was the title of the paper by Dr N. C. Wright. He emphasized the need to harmonize national laws, especially in view of the vast expansion of world trade in agricultural products. Regional agreements have already had some success, and the Common Market is shortly to issue unified regulations on food colours, binding upon the Six. The regional

approach is limited in the results it can achieve, but the FAO is constituted on a world-wide basis. In 1957, for example, work began on designations, definitions and standards for milk and milk products, and a Code of Principles has been accepted by some 30 governments.

Dr C. A. Morrell, F.R.S.C., Director of the Food and Drugs Directorate, Canada, discussed the problems of pure food and legislation in that country. Canada's first food and drug law became effective in 1875. In 1877 half of the 180 samples tested were found to be adulterated, but in 1958 some 30,000 samples of suspected materials were analysed, and 20 per cent were found unsatisfactory. In 1877 there were no legal standards to conform to. In 1958, however, a large proportion of the unsatisfactory foods violated a legal standard, though not many could be classified as grossly adulterated in chemical terms. An important function of the Canadian Food and Drug Directorate is scrutiny of advertising and labels to ensure that consumers are not misled.

Mr T. McLachlan (*left*), Chairman of the Exhibitions Committee, with Mr Christopher Soames, Minister of Agriculture, Fisheries and Food, and the Mayor of Westminster

Dr F. H. Reuter, Professor of Food Technology, University of New South Wales, spoke on Australian problems. Under the Constitution Act of 1900 each state was concerned with its own internal affairs, and the regulations of the various states soon became increasingly inconsistent with each other. To overcome this, the National Health and Medical Research Council set up a Food Standards Committee (FSC) in 1952 to draw up draft food regulations suitable for adoption in all states. The food-processing industries had meanwhile formed the Food Technology Associations, one in each state, and in 1949 these formed the Council of Australian Food Technologists Associations (CAFTA), which co-operates closely with FSC. As a result, food legislation is now growing more uniform.

Dr G. P. Larrick, Commissioner of Foods and Drugs, Department of Health, Education and Welfare of the United States, said that the housewife is saved much time by 'convenience foods,' but she has lost control over the ingredients and the conditions under which such goods are prepared. Modern food technology has made food additives a major concern. The Food, Drug and Cosmetics Act of 1938 put the burden of proof of harmfulness on the government, but an amendment in 1954 enacted that sellers and users of pesticides must establish that residues left under the proposed conditions of use are safe. The Food Additives Amendment of 1958 requires those who sell or use new additives to furnish safety data and analytical methods to the Food and Drug Administration, which will issue a tolerance regulation specifying permissible conditions of use.

Finally, Dr A. C. Frazer, Professor of Medical Biochemistry and Pharmacology, University of Birmingham, and President of the British Food Manufacturing

Dr A. J. Amos, Chairman of the Executive Committee, and Mrs Amos receiving the Lord Mayor (Sir Edmund Stockdale) and the Lady Mayoress at Guildhall

Industries' Research Association, spoke on 'The Integration of Food Research.' Food production is concerned both with the improvement of existing materials and in securing an overall increase in the total output. There is probably sufficient carbohydrate, but fat is in relatively short supply, and it is difficult to see where an adequate supply of good-class protein can be obtained. Processing of foods may give rise to some modification in nutritional properties, but this only assumes importance if the food concerned is an important source of that nutrient in the diet as a whole. New methods, such as sterilizing foods by irradiation, must also be investigated.

The needs, he said, are obvious—more research on all aspects of the question and closer integration of effort among all engaged in it.

JOHAN GADOLIN, 1760-1852

By K. R. WEBB, B.SC., PH.D., F.R.I.C.

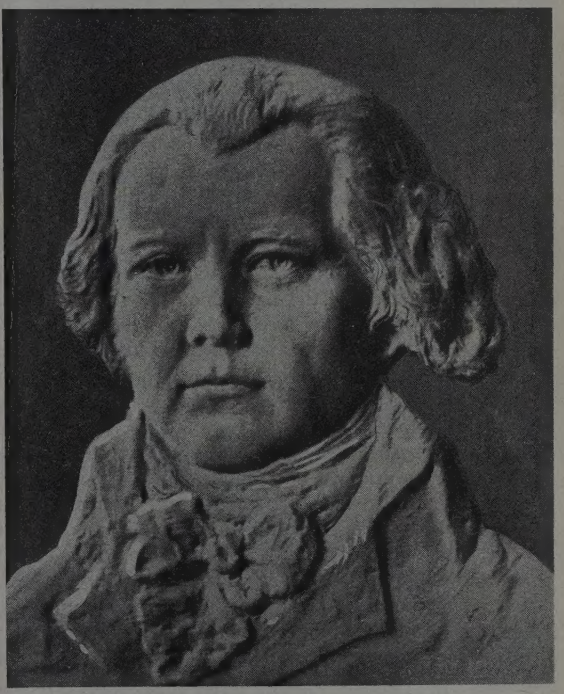
Chemistry Department, University of Southampton

The 200th anniversary of the birth of Johan Gadolin, the most distinguished scientist produced by Finland during the eighteenth century, occurred on 5 June this year. He was born at Åbo (Turku in Finnish), an old university city and ecclesiastical capital of Finland. Johan's father, Jacob Gadolin (1719–1802), had a delightfully eighteenth-century career. Starting as astronomical observer at the University in 1748, he became successively professor of physics (1753) and then of theology (1762) in the University of Åbo, and, having been made provost of the cathedral in 1779, finally succeeded to the bishopric of Åbo in 1788.[1] On his mother's side, Johan's grandfather was Johan Browall, or Brovallius (1707–55), who had also held the see of Åbo, had previously been professor of natural history in the University, and was a contemporary and friend of Carl Linnaeus (1707–78), the great Swedish naturalist and systematist.

Young Johan attended the high school of his native city, and then went to its University, where he heard chemistry lectures by Pehr Adrian Gadd (1727–97) who was Professor of Physics, Agriculture and Chemistry at Åbo. After completing his course there, Gadolin crossed over to the Swedish mainland to study at Upsala with Torbern Bergman (1735–84), one of the foremost chemists of the time, famous for his work on analytical chemistry, and professor of chemistry and pharmacy at the University. There he worked on metallurgical and mineralogical topics, in which he was afterwards to make his name, and also began his work on specific heat and attempted to determine the absolute zero of temperature. According to Wolf,[2] Gadolin 'appears to have been one of the first, if not the first, to introduce a formula for the temperature of a mixture, in which due allowance was made for specific heat.' He seems to have had fairly clear ideas about the allowance which must be made in thermal mixing experiments for the heat which the mixture imparts to the containing vessel. This work was an extension and correction of earlier studies by G. W. Richmann (1711–53), professor at St Petersburg, and more often remembered for his work on atmospheric electricity, which led to his tragic death. It was published in Åbo in 1784 (Gadolin and Maconi: *Dissertatio chemicophysica de Theoria Caloris Corporum Specifici*).

During his four-year stay in Upsala, Gadolin became friendly with C. W. Scheele (1742–86), then nearing the end of his short but amazingly fruitful life as a chemical investigator. There still remain the contents of a letter from Scheele which Gadolin received in 1781 and of which he afterwards published a German translation, now also available in English,[3] describing the formation and behaviour of white lead.

When Bergman died in 1784, Gadolin was a candidate for his chair at Upsala; however, J. A. Afzelius (1753–1837), Bergman's nephew but a mediocre chemist, was chosen and Gadolin returned to Åbo where, in 1785, he was made 'Professor Extraordinarius' in the University. The duties of this post seem to have been quite nominal, and Gadolin spent the years 1786–88 mainly in foreign travel—in Germany, Holland and England.



According to one account:[4] 'Whilst in London he published a memoir on the analysis of iron ores by wet methods, in which he gave the first suggestion of a method of volumetric analysis'; also, in conjunction with Adair Crawford (1748–95), a friend of Joseph Black's, he undertook a series of determinations of the latent and specific heats of ice. He also visited Ireland and made the acquaintance of the eccentric Irish chemist Richard Kirwan (1733–1812)—who detested flies, and from a weakness of the throat lived on ham and milk—with whom he later corresponded on mineralogical matters.

During his travels, Gadolin must undoubtedly have heard much about the newer developments in chemistry taking place, especially in France as a result of the work of Lavoisier (1743–94) and his associates, and the gradual overthrow of the phlogiston theory. He was soon converted to these more correct principles and, back in Åbo in 1789, he adopted the newer ideas in his chemical teaching, and later sought to give them wider currency in Sweden and in Finland by publishing the first Swedish textbook to embody Lavoisier's teachings; this was his *Inledning till Chemien* (Introduction to Chemistry), Åbo, 1798.

In 1797, on the death of P. A. Gadd, Gadolin was chosen to succeed him as Professor of Chemistry at Åbo. This office he held for 25 years until he retired, aged 62, in 1822. However, it was between about 1788 and 1803 that Gadolin's chemical activity was most intense, and during that period a number of papers dealing with chemical matters were published, in addition to several memoirs on thermal studies. Examples of these chemical papers are: the assaying of iron ore by a wet method (1788); the power of copper to precipitate tin from its solutions in tartaric acid (1788); the purification of crude saltpetre (1791 and 1793); a description of an improved cooling apparatus for use in distilling spirit (1791); the decomposition of silicate of potash by lime-water (1797); the precipitation of lime by silica (1798); observations on carbon (1802); and three disquisitions on an examination of the objections of H. R. Gmelin to Lavoisier's theory of acids (1803). But more important than any of these was the work reported in a paper of 1794 and entitled (in translation): 'Examination of a black heavy variety of stone from Ytterby stone-quarry in Roslagen.' This black rock had been discovered there in 1788 by Carl Axel Arrhenius (1757–1824), a chemist and mineralogist who was also an officer in the Swedish artillery, and who named it *ytterbite*.[5] From this material Gadolin obtained about 38 per cent of a new earth, which came to be called *yttria*, and was the first rare-earth material to be isolated. A few years later A. G. Ekeberg (1767–1813) confirmed, in general terms, Gadolin's analysis, and *yttria* was also investigated by other prominent analytical chemists of the time, in particular the German chemist, H. M. Klaproth (1743–1817), and the Frenchman, L. N. Vauquelin (1763–1829); but it was not until the work of the Swedish chemist, C. G. Mosander (1797–1858), some 40–45 years later, and with considerably improved analytical techniques and reactions available, that the full complexity of the original yttria began to be realized. Ultimately, the black mineral ytterbite was renamed *gadolinite* by the mineralogists, and Gadolin was made even more assuredly immortal in chemical nomenclature when one of the later-isolated rare earths was named *gadolinia* by Lecoq de Boisbaudran in 1886, thus providing the name gadolinium for the metal it contained.

After Gadolin's retirement from his chair in 1822, he continued to engage in scientific work for some years. His last paper, published in 1827, dealt with observations on the 'white copper' of China, the so-called *pe-tong* or *paek-tong* (in modern terms, *paktong*), an alloy of copper, zinc and nickel. Doubtless further studies would have followed, but in November 1827 a disastrous fire destroyed almost the whole city of Åbo, including the University, its valuable library, and Gadolin's laboratory and mineral collections. One account tells us[6] that 'Before this calamity Åbo contained 1,110 houses and 13,000 inhabitants; and its university had 40 professors, more than 500 students, and a library of upwards of 30,000 volumes, together with a botanical garden, an observatory and a chemical laboratory.' The university was later re-established at Helsingfors (Helsinki), some 60 miles away, which had been the capital since 1819. For Gadolin, the catastrophe ended his scientific career. He moved from Åbo into the country, but lived on quietly in retirement for another 25 years, dying, aged 92, at Wirmo on 15 August, 1852.

A memorial volume on Gadolin and his work (including his teaching and correspondence), by E. Hjelt and R. Tigerstedt, was published in 1910 by the Finnish Society of Sciences, and more recently (1935) the Gadolin Fund was established by the Society of Finnish Chemists. The first award of the Gadolin Medal, made possible by this Fund, was to Ossian Aschan and Gustav Komppa in 1937. On the obverse of this medal is a noble portrait of Gadolin, whose placid, intellectual features mirror the inner calm and contentment of a quiet, industrious and happy life.[7] On the reverse appears a group of five chemists at a very obviously overcrowded chemical bench, symbolically engaged in the separation of the rare earths of gadolinite, which splits above their heads into a many-rayed fan of its constituent elements, including yttrium, ytterbium, holmium, erbium, thulium, scandium and terbium.

The portrait medallion of Gadolin is reproduced here by courtesy of Dr Mary Elvira Weeks, author of *Discovery of the Elements*, and the Mack Printing Company.

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THE PRESENT-DAY TEACHING OF ORGANIC CHEMISTRY

By HELENA BRADBURY, B.SC., PH.D., F.R.I.C.

*Chairman, Liverpool and North-Western Section**

The object of my talk this evening is to give a brief review of developments in the theories which account for organic reactivity, and to illustrate by means of examples certain alterations in the mode of presentation of the subject matter which have arisen as a result of the incorporation of these theories into modern chemical thought.

The number of organic compounds known is now so large and the kinds of reactions in which they participate are so varied that today it would be well-nigh impossible to envisage the study of organic chemistry as the mere acquisition of factual knowledge, however systematically presented. In my view, it is only by considering the reactions of organic compounds as illustrative examples of fundamental principles that the student is enabled to interpret them in terms of a logical and unified pattern of chemical behaviour. These 'fundamental principles' to which I refer could have no place in classical organic theory, since they stem from the discovery of the electron by Thomson and Wiechert in 1897.

Classical theory was predominantly concerned with the relative positions of atoms in a molecule, and with the establishment of structural formulae. It was highly successful during the period of empirical discoveries from 1855 to 1900, and enabled chemists to classify the behaviour of organic compounds on the basis of the functional groups they contained.

At this time, however, the nature of valency forces was not understood; classical theory was thus unable to give any information about the magnitudes of the binding-forces which exist between atoms, nor to give much indication of the ease or difficulty with which organic reactions might be likely to proceed.

One might describe it as a 'static' theory, and even in the early years of this century organic chemists were beginning to be aware of, and to deplore, the lack of any dynamic element in it.

Modern organic theory does, however, take into account the dynamic nature of organic reactions. Electronic theories in use today are based upon our present knowledge of the behaviour of electrons and of the structure of the atom, and it is recognized that it is the valency electrons of atoms which constitute the binding-forces between atoms in a molecule.

Since chemical bonds are electronic in their nature, they should be responsive to electric and magnetic forces imposed upon them both from within the molecule and outside it; this underlying concept has proved most fruitful in assisting the chemist to understand aspects of chemical reactivity which classical theory, with its many limitations, was unable to explain.

The application of physical methods to the study of the structure of organic molecules has made a further valuable contribution to our ideas concerning their reactivity; a discussion of these methods is not possible here, but it should not be overlooked that X-ray and electron-diffraction studies, spectroscopic measurements, and measurements of dipole moments have given physical significance to many of the seemingly abstract theoretical concepts underlying modern views about the behaviour of organic compounds.

In talking about types and properties of bonds, the classification of organic reactions and reagents, and mentioning briefly the functions of catalysts, I shall hope to show you that electrons, no less than the atomic nuclei which constrain them, play a highly significant part in governing reactivity.

TYPES AND PROPERTIES OF BONDS

We distinguish two main types of chemical binding, viz.

(i) electrostatic bonds existing between the oppositely-charged ions of an electrolyte;

(ii) covalent bonds which hold together the atoms constituting the molecule of a non-electrolyte.

In the formation of both types of bonds, the participating atoms are enabled to acquire the particularly stable extra-nuclear electronic configuration of the inert gases, *e.g.* the atom of chlorine can achieve stability in either of the following ways:

$$Cl\ (2, 8, 7) + e = \bar{C}l\ (2, 8, 8).$$

where the chlorine atom has achieved the inert gas structure of neon by accepting an electron,

or $$2\ Cl\ (2, 8, 7) = :\ddot{\underset{\cdot\cdot}{C}}l : \ddot{\underset{\cdot\cdot}{C}}l :$$

where each atom in the chlorine molecule has achieved the inert gas structure of neon by the sharing of an electron-pair (only outer valency electrons are shown in the foregoing formulae).

The covalent bond is of particular interest in organic chemistry, since most organic reactions involve the fission and formation of bonds of this type.

Covalent bonds between a pair of atoms may involve the sharing of 2, 4 or 6 electrons between the two atomic nuclei.

These are identified with the single, double and triple bonds of Kekulé's structural formulae.

* Dr Bradbury's Chairman's Address was delivered on 1 October, 1959, and is reproduced with the author's permission and by local request.

THE TWO-ELECTRON COVALENCY

In this type of bond, two electrons are shared between two atoms A and B in the manner described above.

We talk in terms of numbers of electrons, as though they were particles, but de Broglie in 1924 suggested that electrons possess a dual nature, sometimes behaving as particles and sometimes having the nature of wave motion. Because of these considerations, it is impossible to locate precisely the position of the shared electrons with respect to the two atomic nuclei of A and B, and we can only envisage them as giving rise to a diffuse electron-cloud surrounding the two nuclei, which is called a molecular orbital.

The probability of finding the two bonding electrons somewhere between the nuclei of A and B is highest, and thus we say that the electron-density between the nuclei is greatest. It is this concentration of negative charge between the two atomic nuclei which is responsible for holding them together.

If the two atoms A and B are entirely similar in electronegativity, the electron-cloud will be symmetrical about their two nuclei, and exact electrical neutrality will be maintained in the molecule. But if A and B are of different electron-acceptor property, the electron-cloud will be permanently displaced towards the nucleus of the more electronegative atom, and fractional charges, opposite in sign and much smaller than the charge on an electron, will develop on the two atoms in question.

The first type of bond, exemplified by those found in symmetrical diatomic molecules like H_2, Cl_2, Br_2 and in the C–H and C–C bonds of paraffins, is termed non-polar; polar two-electron bonds occur in H–Cl and in many molecules in which carbon or hydrogen is singly bound to a more electronegative element, *e.g.* alkyl halides, alcohols and amines. Bonds between carbon and more electronegative atoms of the first short period of the periodic table show a gradation in permanent polarity, due to the increasing positive charge on the nucleus of the atom attached to carbon.

$$C-C \quad C-N \quad C-O \quad C-F \longrightarrow$$

Permanent polarity of bond increases

Bonds between carbon and the halogens show a similar gradation in polarity.

$$\begin{matrix} C-F \\ C-Cl \\ C-Br \\ C-I \end{matrix} \Big\downarrow$$

Permanent polarity of bond decreases

Molecules with permanently polar bonds of this type are capable of undergoing displacement reactions with reagents which are themselves dipoles or ions; oppositely charged portions of reactant and reagent are attracted electrostatically, thus facilitating formation of a new bond as shown at the head of the next column.

$$OH^- + CH_3^{\delta+}-Br^{\delta-} \longrightarrow CH_3OH + Br^-$$

$$CH_3-\overset{\delta-}{\underset{\|}{C}}(=O)-O^{\delta+}-H + OH^- \longrightarrow CH_3COO^- + H_2O$$

The non-polar bonds of paraffins are unaffected by most reagents of this type.

Electron displacements arising from the unequal sharing of electrons can be transmitted along a chain of atoms, often affecting the reactivity of a more remote part of the molecule.

Considering the series of acids whose dissociation constants are given below,

CH_3COOH	$1{\cdot}8 \times 10^{5}$ K
CH_2FCOOH	2·20
CHF_2COOH	5,700
CF_3COOH	59,000

it is apparent that the successive replacement of hydrogen atoms by powerfully electron-attracting fluorine atoms at α-carbon induces increasing polarity of the O–H bond, which is reflected in its ease of rupture in aqueous solution.

Another important property of bonds is their polarizability by external forces such as may be exerted by molecules of polar reagents, solvents and catalysts.

The more easily the electrons of a bond can be displaced from the position which they occupy in the resting state of a molecule, the more readily can the bond be broken.

Two-electron bonds between carbon and more electronegative atoms of the first short period are not readily polarizable, the valency-electrons being strongly constrained by the atomic nuclei. As the atomic number of the atom bound to carbon increases, however, the valency electrons are screened more and more effectively from the nucleus by the intervening filled electron-shells, and the bond becomes more polarizable. Thus, although permanent polarity decreases in the series C–Cl, C–Br, C–I, bond polarizability increases.

Kinetic studies indicate that in substitution reactions of similarly-constituted alkyl halides, the iodides react more readily than the bromides, and these in turn are more reactive than the chlorides.

MULTIPLE BONDS

Many pairs of atoms can jointly form bonds in which four or six electrons may be shared between the two nuclei, *e.g.*

$$C=C \quad C=O \quad -C\equiv C-$$

Classical organic theory envisaged a complete similarity between the two olefinic bonds of the ethylene molecule, but it is now considered that the two sets of paired electrons occupy molecular orbitals at different energy-levels.

One electron-pair occupies an orbital such as has been described for the two-electron bond, called a

σ-orbital, whilst the other pair occupies an orbital in which the electrons are at a higher energy-level, and much more accessible for reaction. This is called a π-orbital, and it lies above and below the plane holding the olefinic carbon atoms and the σ-orbital.

Similar considerations apply to the distribution of electrons in other multiple bonds.

These bonds may be non-polar or permanently polar, as a result of equal or unequal electron-sharing, but an important general characteristic is the ready polarizability of their π-electrons. In the majority of reactions of such unsaturated groups the σ-bond remains unbroken, whilst the π-electrons are involved in the formation of new bonds.

CONJUGATED BONDS

Molecules like benzene and the conjugated olefins are generally represented as possessing alternate single and double bonds. There is, however, considerable evidence which suggests that the π-electrons of a conjugated system interact with one another in such a way that they occupy an extended molecular orbital common to all the conjugated atoms. (An important condition of the formation of such extended π-orbitals is that the atoms associated with them should lie in the same plane).

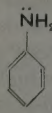
Measurement of bond-distances between the carbon atoms in the benzene molecule shows them all to be 1·39 Å long. The C—C bond-distance in ethane is found to be 1·54 Å, whilst the C = C bond-distance in ethylene is 1·34 Å.

Thus, bonds between carbon atoms in benzene are not of two kinds, but only of one kind, and they are neither typically paraffinic nor typically olefinic in character.

The 'unsaturation electrons' of benzene are therefore far less localized than the Kekulé formula would suggest. The greater the delocalization of electrons, the lower the energy level of the molecular orbitals which they occupy, and thus a molecule with conjugated bonds gains stability as a result of π-electron interaction.

This phenomenon is also referred to as resonance, and molecules with conjugated bonds are said to be resonance-stabilized. Similar interaction occurs between the π-electrons of a multiple bond or aromatic nucleus and the unshared electrons of an atom conjugated with either of these systems.

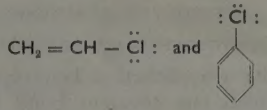
For example, the unshared electrons on the nitrogen atom of the aniline molecule are less localized than they appear to be in the Kekulé formula given below.



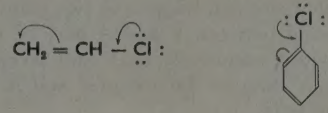
Thus, they are not so readily available for proton-capture as are the unshared electrons on the nitrogen atom of an alkylamine, where this type of interaction cannot take place. Consequently, aniline is a weaker base than is cyclohexylamine.

Recognition of such electronic interactions has provided a logical basis for the interpretation of many of the reactions of conjugated systems, and for the observed differences in reactivity of the same functional group attached to saturated and unsaturated carbon.

It will be apparent from the foregoing that no Kekulé formula which preserves the conventional rules of valency can adequately represent the true distribution of valency-electrons in a conjugated system, since every formula written thus suffers from the disadvantage that it represents the valency electrons as being too localized. Yet the Kekulé formula is an indispensable symbol to the organic chemist. In order to give a more adequate indication of interaction between valency-electrons, additional symbols have been introduced, *e.g.* vinyl chloride and chlorobenzene are conventionally written:



Curved arrows may be used to indicate the trend, but not the extent of the interaction between valency electrons:



Vinyl chloride and chlorobenzene are thus recognized as having C–Cl bonds possessing 'partial double-bond character.'

Only accurate physical measurements can give quantitative significance to this statement, yet the above representation indicates that the C–Cl bond of vinyl chloride or of chlorobenzene is less polar than the C–Cl bond of ethyl chloride.

The degree of polarity of the C–Cl bond accounts to some extent for its reactivity, and it is well known that the halogen atom in vinyl chloride, and in chlorobenzene, is not readily displaced from the molecule.

TYPES OF REACTIONS

The covalent bond may be formed or broken in two different ways, which define for us the two main types of organic reactions.

Firstly, formation or cleavage of a covalency between two atoms may take place in such a way that each atom contributes or receives one of the two bonding electrons. Reactions in which bonds are formed or broken by this process are known as homolytic reactions, and involve neutral and highly-reactive free radicals as intermediates. Such free radicals are produced in many thermal decompositions, photolyses and reactions of organic compounds at catalyst surfaces.

Secondly, a covalency may be formed or broken in such a way that one atom contributes or receives both the bonding electrons. Reactions involving these processes are known as heterolytic reactions and often give rise to ionic intermediates. They take place in solution at comparatively low temperatures, and are those most frequently encountered in organic chemistry.

Many factors influence the mode of fission of covalent bonds, including the inherent bond-properties of polarity and polarizability already referred to.

Bonds that are polar and further polarizable by external reagents (*e.g.* the C–halogen bond of alkyl halides, the C=O bond of ketones) are those most likely to undergo heterolysis, whereas non-polar and very weakly polarizable bonds (*e.g.* C–C and C–H bonds of paraffins) are far less prone to fission by heterolytic processes.

HETEROLYTIC REACTIONS

CLASSIFICATION OF REAGENTS

If we consider a hypothetical heterolytic substitution reaction in which one covalent bond is formed and another broken, *e.g.*

$$Y + A{-}B = Y{-}A + B$$

it is evident that this can happen in two ways.

The new bond between Y and A may be formed by electrons provided exclusively by Y and accepted by A, or conversely, Y may be the acceptor and A the donor of the electron pair.

An organic reagent is classed as nucleophilic if it donates electrons to form a new bond between itself and another reacting species, and as electrophilic if it accepts electrons in the formation of a new bond.

These definitions apply equally well to reactions other than substitutions; in condensation, elimination and addition reactions, a number of covalent bonds may be formed or broken, but the classification of reagents in this way still depends upon the initial step in the attack of reagent upon reactant.

Obviously, the electron-requirements of the two atoms Y and A in the above equation must be complementary in nature; if Y is nucleophilic (electron-rich and nucleus-seeking) it will only be attracted to and form a new bond with A–B if A is electrophilic (electron-poor or electron-seeking) and vice versa.

Bases, molecules with atoms possessing unshared electrons, non-polar molecules with π-electrons, reducing agents, anions and sources of anions are nucleophilic reagents; proton-acids, Lewis acids, some cations and oxidizing agents are electrophiles.

The following substitution reactions of primary alkyl halides are all fundamentally of the same type. In each case the alkyl halide is being attacked by a nucleophilic reagent, and the result is the displacement of halide ion from a carbon atom of low electron-density.

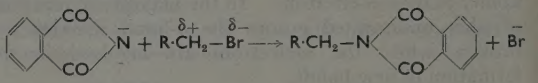
$$\bar{O}H + R{-}\overset{\delta+}{C}H_2{-}\overset{\delta-}{Br} \longrightarrow R{\cdot}CH_2OH + \bar{B}r$$

$$H_3N: + R{-}\overset{\delta+}{C}H_2{-}\overset{\delta-}{Br} \longrightarrow R{\cdot}CH_2{-}\overset{+}{N}H_3\,\bar{B}r$$

$$\overset{\delta-}{C}H_3{-}\overset{\delta+}{M}g{-}Br + R{-}\overset{\delta+}{C}H_2{-}\overset{\delta-}{Br} \longrightarrow R{\cdot}CH_2CH_3 + MgBr_2$$

$$\bar{C}H(COOEt)(COCH_3) + R{\cdot}\overset{\delta+}{C}H_2{-}\overset{\delta-}{Br} \longrightarrow R{\cdot}CH_2CH(COOEt)(COCH_3) + \bar{B}r$$

(anion of sodio-acetoacetic ester)



(anion of potassium phthalimide)

Alkylations by means of alkyl halides play an important part in organic synthesis. The essential similarity in type between reactions which at first glance appear to differ widely from one another should be emphasized wherever possible. The recognition of general patterns of behaviour is of great assistance in the correlation and retention of accumulated knowledge, and this cannot be achieved without some understanding of the mechanisms of organic reactions.

In classifying organic reagents, it should not be overlooked that many dipolar molecules can function as electrophiles or as nucleophiles, depending upon their environment. Thus, in describing alkyl halides as electrophilic we are taking into account the fact that the positively-charged end of the carbon–halogen dipole is the more reactive. Yet the halogen atom possesses unshared electrons and should therefore show some nucleophilic character, though we should expect it to be weak, since electrophilic attack on an alkyl halide would result in the formation of carbonium ions of low stability. It is therefore only in the presence of powerful electrophiles that alkyl halides show these subsidiary nucleophilic properties.

HETEROLYTIC REACTIONS

THE ROLE OF CATALYSTS

The catalysts generally employed in heterolytic reactions are

(i) proton-acids (proton-donors)

(ii) Lewis acids (electron-acceptors)

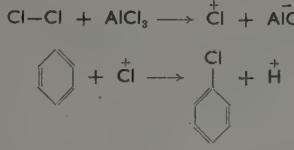
(iii) bases (proton-acceptors)

The function of such catalysts is to react with polar or polarizable molecules in such a way as to increase the polarity or even bring about ionization of the latter, producing from them more highly reactive species.

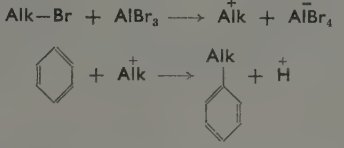
Lewis acids and proton-acids enhance the electrophilic character of molecules they attack in this way; base catalysts enhance the nucleophilic character of molecules with which they react.

The following substitution reactions of benzene (a weak nucleophile) with various electrophilic reagents are similar in type. In each case the overall reaction comprises more than one step, the first involving the catalyst and the electrophile.

Chlorination

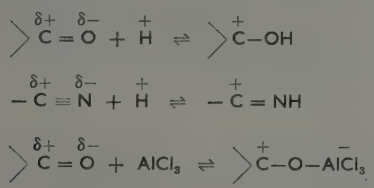


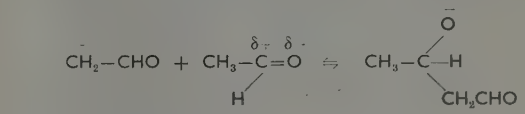
Alkylation



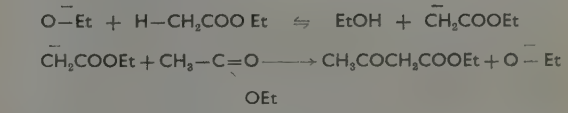
The chloronium and carbonium ions which effect electrophilic substitution in the benzene nucleus are both more powerful electrophiles than are the molecules from which they are produced.

Compounds with multiple bonds may be polarized to give more reactive species by use of the same types of catalysts, *e.g.*





(aldol condensation)



(Claisen condensation)

The Knoevenagel, Dieckmann and Thorpe reactions are of the same fundamental type as the above.

In the short time at my disposal I have endeavoured to concentrate upon the unifying principles of electronic theory, but there are yet many facts about the reactivity of organic compounds which they fail to explain. It is now recognized that the shapes of organic molecules can influence their reaction-rate, and consequently stereochemical considerations are playing an increasingly important part in the interpretation of many aspects of organic reactivity which have hitherto been imperfectly understood.

SOME PHYSICO-CHEMICAL PROBLEMS IN SEMICONDUCTOR PHYSICS

By G. F. J. GARLICK, PH.D., SC.D., F.INST.P.
Professor of Physics, University of Hull

The electrical and optical properties of semiconductors, with which we may couple also phosphors and photoconductors, are very sensitive to crystal imperfections such as lattice atom vacancies, interstitial atoms and traces of impurity. Reproducibility of crystal properties is usually possible only when purification and control of stoichiometry are better than a few parts of the imperfections per million of substance. Much progress has been made in determining the relations between such imperfections and the interesting characteristics of the compounds of elements in groups II and VI. The materials in question are set out in Table I.

TABLE I

PHOSPHORS, PHOTOCONDUCTORS AND SEMICONDUCTORS OF GROUPS II AND VI

ZnO	CdO	HgO
ZnS	CdS	HgS
ZnSe	CdSe	HgSe
ZnTe	CdTe	HgTe

Zinc oxide and zinc and cadmium sulphides have for long been well known as commercial phosphors and have also been foci of fundamental research. Today zinc sulphide is a standard television-screen phosphor

while cadmium sulphide is gaining importance as a sensitive photoconductor for X-ray detection and solid-state image devices. The general feature of this family is that increase in atomic weight of either anion or cation moves the optical properties to the infra-red region of the spectrum. It also increases the covalent component of the crystal-lattice binding, and sometimes changes the structure from hexagonal to cubic (blende). The lighter compounds sublime on heating, and so single crystals have to be grown from the vapour phase.

Other phosphors, such as cadmium telluride, can be directly synthesized and grown from the melt if the more volatile component is buffered to prevent its loss.

Various crystal-growth problems for zinc and cadmium sulphides, typical of the subliming materials, have been studied. Methods for vapour deposition of crystals have been reviewed by Lawson and Nielsen[1] in a recent monograph. The basis of our own method is that of Reynolds and Czyzack[2] developed by Hamilton.[3] A static atmosphere of hydrogen sulphide is maintained in a closed muffle of silica with a temperature gradient along its length. Precipitate placed at the hot end sublimes and deposits at other places down the gradient. This thermal diffusion is slow compared with the gas-flow method[4] but it avoids excessive dendritic growth and formation of thin, fragile platelets. Crystals grow in columnar habit for proper adjustment of temperature and pressure, although a few dendritic specimens grow at intermediate places nearer the original material. Czyzack has recently produced clear crystals weighing tens of grams by a similar method (private communication). In such a system chemical equilibrium is complex, since both gas and precipitate undergo some dissociation. Thus conditions may be oxidizing or reducing according to temperature and pressure. Other factors such as minute traces of halogen alter growth rates and also act as reducing agents in the system. Hamilton was able to show that the columnar crystals grow by two-dimensional nucleation,[5] whereas the dendritic growth and that on the precipitate itself must be produced by means of a screw-dislocation system.[6]

PHYSICAL PROPERTIES AND CRYSTAL CONSTITUTION

Luminescence properties in zinc and cadmium sulphides depend strongly on the slight departure from stoichiometry, or in other words on lattice vacancies.[7] Vacancy generation can be promoted by adding specific impurities to the crystal in preparation or in subsequent heat treatment. In terms of energy-band theory, vacancies give discrete levels in the forbidden zone, which can be normally empty or full according to the state of oxidation or reduction, *i.e.* depending on the chemical potential or position of Fermi level in the band model. In the oxidized state, infra-red luminescence bands appear in zinc and cadmium sulphide owing to transitions of electrons from vacancy states back into valence-band levels.[8,9] The slightly reduced state leads to the more familiar visible or near visible luminescence transitions between conduction levels and vacancy states. Cadmium telluride has proved to be a useful system for these studies since the position of the Fermi level or chemical potential can be carefully controlled in growth[10] from the melt. Luminescence bands extending further into the infra-red appear in succession as more reduced conditions (N-type crystals) are obtained.[11] Corresponding changes occur in the spectral response of photoconduction.

From this it may be seen that production of compounds between elements of groups II and VI, with controlled properties and in single crystal form, is providing a means of studying semiconductor crystals of binary type with important practical applications in luminescence and photoconduction.

(Birmingham and Midlands Section, 6 April.)

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Register of Fellows and Associates, 1960.—A new edition of the *Register* is about to be prepared and will contain the names, qualifications, addresses and occupations of all who are Fellows, Associates or Graduate Members of the Institute on 31 October.

Fellows, Associates and Graduate Members in Great Britain and Ireland will receive their card this month.

The importance of an up-to-date and accurate *Register* can scarcely be over-emphasized. To avoid delays in publication and subsequent correspondence resulting from incorrect entries, **members are asked to co-operate by filling in their cards carefully and legibly and by returning them forthwith.**

If any member does not return a card his entry will not include letters denoting corporate membership of qualifying professional bodies other than the R.I.C. or any reference to occupation or telephone number, and the *registered* address will be given.

The Council reserves the right to decide which designatory letters representing qualifications shall be accepted for inclusion in the *Register* and to authorize the amendment or exclusion of other particulars that are not stated in the form required.

Book Reviews

WORLD REVIEW OF NUTRITION AND DIETETICS. Edited by G. H. Bourne. Pp. viii + 272. *London: Pitman Medical Publishing Co. Ltd*, 1960. 60*s*.

The editor of this new Review is in more than one sense a much-travelled man. He has reached Emory University, Georgia, USA, from the University of Western Australia in Perth via the University of Oxford and the London Hospital Medical School; he now concerns himself with nutrition on a broad front, having studied anatomy, still officially his own subject, histology, histo-chemistry and biochemistry. He was, moreover, much involved in nutritional problems, more particularly on the instructional and propagandist side, during World War II in Great Britain.

We should thus expect, and in fact we find, that any composite volume on nutritional subjects edited by Professor Bourne would have contributions not only from experts in different countries, but also from those concerned with the tributary sciences that flow into the main stream of nutritional advance. So it is that the subjects covered include, besides Professor E. V. McCollum's introductory 'History of Nutrition' (pp. 23), sections on the relationship between certain sex hormones, male or female, with protein metabolism and growth; vitamin C biosynthesis; the latest information about tropical protein malnutrition ('kwashiorkor'); basal metabolism of the Japanese; vitamin B_{12}; nutritional anaemia; the bearing of nutrition on tumour formation and growth; isotopes as weapons in nutritional research; and the nutrition of the foetus, with special reference to the effects of nutritional deficiencies.

The authors come from five different countries; the resultant cosmopolitan nature of the volume is doubtless in part an expression of the editor's own attitude to the global nature of scientific problems and their solutions, and also a result of his advisory editors' counsel, for there are 11 of them from six different countries—five from Great Britain, two from the United States, and one each from Belgium, the Netherlands, France and Switzerland. Amongst these advisers we find at least five of the acknowledged elder statesmen in a science no longer so young as not to possess any.

It is impossible to review even in broad terms the ten diverse sections of this book: each could justify a review to itself. It must suffice to say that the names of the 16 authors (and of the advisory editors) are, along with Professor Bourne's, in themselves a guarantee of authoritative statements based on wide and deep knowledge. There is a vast amount of information, new and not so new, to be found in the 200 pages of text, to say nothing of the 32 pages of references, distributed over the separate sections, or the seven pages of index. It should be added, however, that the dimensions of the book, appreciably larger than those of the ordinary standard treatise, although smaller than those of many periodicals (including this *Journal*), have allowed for printing the text in double columns; this, combined with a fairly closely-set type, has provided economical use of the type area, even if it does not make for easy reading. Whatever disadvantage this has must be set against the generous supply of matter thus made possible.

Two comments, one particular and one general, seem to me worth making. First, as a steadfast admirer of McCollum's pioneering work in the field of experimental nutrition and also of his mastery of exposition in scientific prose, I find myself still stunned to find that a 'history' of nutrition by one whom I have held for 40 years to be a leader in the subject can be written with no mention whatever of Gowland Hopkins, Drummond or Charles Martin, and the more so because I can find no other flaw in a survey that seems to me masterly for both condensation and objectivity. This section is, incidentally, unique in the volume—and in most others that have come my way—by virtue of its double 'bibliography', for there are at the end two separate lists of references, one numerical and the other alphabetical, corresponding with two indications in the text. This marriage of the Harvard and the 'serial' systems is not used in the rest of the book, which has kept exclusively to the former system.

Secondly, one must again refer to the doubt remaining in the minds of those who, on an occasion like this, exclaim almost instinctively, 'What, another journal?' For we are told that this is intended to be an annual publication, not an occasional one, and it must therefore automatically raise the question, even if it does not elicit the exclamation. All, it seems to me, must depend on the value that the volume is found to have for those who buy or borrow it. To propound so empirical, not to say pragmatic, an attitude to the problem presented by a new periodical may seem pusillanimous, but I see no reason for emulating King Canute's courtiers, and prefer to adopt that sapient monarch's wise scepticism about the practicability of stemming tides. The future of this review, in my opinion, cannot be foretold except in such terms as I have indicated, but the status of its editor, contributors and advisers, if it is maintained, gives about as good a guarantee that it has 'come to stay' as can be expected in the present rapidly changing state of scientific boundaries, with the continued increase in the number and varieties of techniques being applied inside and outside the laboratory, and in face of the non-stop procession of new problems that arrive in place of those that have been, or seem to have been, solved.

A. L. Bacharach

LIPIDE CHEMISTRY. D. J. Hanahan. Pp. ix + 330. *New York: John Wiley & Sons Inc.; London: Chapman and Hall Ltd*, 1960. 80*s*.

The arrival of a new book on lipid chemistry, particularly when of moderate length, is always a matter of

interest if only because of one's curiosity as to what will be covered this time. Dr Hanahan has exercised his selection very sensibly and kept to those topics which form the core of the lipid field. The main subjects dealt with, apart from a section on isolation and purification, are phosphoglycerides, phosphoinositides, sphingolipids, glycerides and lipoproteins. Detailed discussion of individual fatty acids and steroids, and of carotenoids and fat-soluble vitamins, has been almost entirely avoided.

The topics considered are approached in an attractive way with up-to-date information and a satisfactory list of references. This, together with an adequate number of formulae and a beautifully printed page, makes the book a pleasure to read. A companion volume by Professor K. Bloch on 'Lipide Metabolism' is planned, and the two books should provide coverage of many of the important areas of present-day study. This volume will naturally attract lipid specialists, but it is also very suitable for non-specialists and for students of chemistry and biochemistry who wish to acquire a sound view of the field. Because of difficulties in purification, and the inherent uncertainty and conflict, lipid chemistry can be made very dull reading, but this, except in one or two places, is not a fair criticism of Hanahan's book. The section on lipoproteins offers a stimulating reminder of the enormous scope of this field for scientific study from a variety of angles. Not least, study of the association forces involved may help to throw new light on enzyme–substrate interactions.

The price of the book is high, but one does acquire the grace and elegance of a well-produced volume.

L. CROMBIE

THE ACTINOMYCETES. VOLUME I. NATURE, OCCURRENCE AND ACTIVITIES. S. A. Waksman. Pp. xi + 327. *London: Baillière, Tindall & Cox Ltd*, 1959. 100*s*.

This, the first of three volumes, provides a comprehensive survey much along the lines of the author's earlier volume with a similar title (*The Actinomycetes, Their Nature, Occurrence, Activities and Importance*. Chronica Botanic Company, 1950). However, there is a great deal of new material, as shown by a bibliography now more than doubled. As would be expected, the chapters concerned with the processes and products of metabolism, including antibiotics, vitamins, pigments, enzymes and various lytic mechanisms show the greatest expansion (53 pages to 130 pages).

From the time in 1914 when his interest in the role played by actinomycetes in the economy of the soil was first aroused, Professor Waksman has continued to make outstanding contributions on both general biological, and latterly, antibiotic activities of these organisms. Students will be particularly interested in his treatment of the historical background, in which four main periods are recognized. In the first, lasting to the end of the nineteenth century, the predominant interest lay in the causation of diseases by actinomycetes in animals and plants. Although the actinomycetes are abundant in nature, they cause only very few human and animal diseases and in plants only the scab disease of potatoes and some root vegetables.

The next forty years are divided equally into first the soil period, with main emphasis on morphology and the humification of organic matter, and then a biological period in which research extended further into physiological and biochemical activities. In 1940, following the advent of penicillin, the antibiotic period started with the exploitation of the long-recognized antagonism shown between some actinomycetes and other micro-organisms sharing the same substrate.

Since the search for new antibiotics was based on the screening of unknown strains for activity, nomenclature and classification gave ground to the intensive studies required for the production and characterization of the antibiotic substance. As a result, diagnosis of species is today extremely burdensome and altogether unsatisfactory. In Volume I nomenclature and systems of classification are treated historically, so we must await the next (Description of Genera and Species of Actinomycetes) to learn what can be done to reduce the present near-chaos. For the moment we are indebted for a most valuable book. It will surely find its place on the shelves of those many workers who, through the antibiotic era, have come to know well what had previously been dismissed as a little-known group of micro-organisms.

A. H. CAMPBELL

QUANTITATIVE PAPER CHROMATOGRAPHY OF STEROIDS. Memoirs of the Society for Endocrinology, No. 8. Ed. D. Abelson and R. V. Brooks. Pp. vii + 103. *Cambridge: University Press*, 1960. 30*s*.

This volume, unlike its predecessors, does not contain the proceedings of a meeting of the Society for Endocrinology, but covers a conference held at the Ciba Foundation in July, 1958. The ten contributions were of variable quality, and covered general aspects of paper chromatography in relation to other available techniques for the analysis of steroids (papers by Morris and Tait and Tait), their direct measurement on paper after chromatography (papers by Bush and Gowenlock), quantitative aspects, results and problems of paper chromatography of aldosterone (Brooks), reducing steroids (Cope), 17-oxosteroids (Smith and Kellie), cortisol (Abelson), bile acids (Wootton and Osborn) and oestrogens and progesterone (Short). The inclusion of all the discussions adds to the value of the book.

Although all the contributions were confined to the use of steroid paper chromatography in physiological and medical research, some of the results and methods may have wider uses. However, this is not a book to

consult for established techniques—it is one that should stimulate careful and thorough methodological research, so that paper chromatographic methods can eventually replace the more tedious partition columns which are still considered to give better resolution of crude mixtures and more accuracy and precision.

While the development of paper chromatographic methods for separating a wide range of steroids has given rise to rapid advances, particularly in physiological and clinical studies, there emerges from this book a realization of the inadequacy of their quantitative application. Difficulties are encountered when extraction from the paper precedes determination, and recoveries by various elaborate elution techniques are not as good as would be desired in all cases. Much time and material is expended on purification of paper before use, and the decomposition of paper during chromatography and development requires further investigation. To overcome some of these problems and to facilitate mass production, methods for automatic scanning of paper strips have been developed, but difficulties may arise from paper 'background' and irregularities in the size and shape of the zones to be measured. The isotopic techniques are of considerable value, and their wider use is likely to yield fruitful results.

H. BRAUNSBERG

GAS CHROMATOGRAPHY ABSTRACTS 1959. Edited by C. E. H. Knapman and C. G. Scott. Pp. ix + 164. *London: Butterworths Scientific Publications*, 1960. 42*s*.

The first volume of this annual publication, which was intended to be a complete collection of abstracts of publications on gas chromatography up to the end of 1958, has already been reviewed here (*J.*, 245). The second volume, which contains abstracts of 1959 publications on the subject, along with some earlier references, has followed with remarkable speed and can be regarded as bringing the abstracting in this field up to date.

The present volume contains 717 references which are abstracted in up to 10 lines of type. The listing of these adopted in the first volume—alphabetically according to the name of the first author—has been discarded in the second, but this change is unimportant, as an author index is included. The form of the subject index favourably commented on in the previous review has been retained; use of this kind of subject index during the past few months has confirmed the first impression that it is admirably suited to tracing a publication quickly when only certain features may be remembered.

At least some of the adverse criticisms of the first volume are still valid. These admittedly are minor ones but could be obviated readily and the general high quality of the publication improved. It has become obvious with use that it would be an advantage if the titles were printed in bolder type than the actual abstract; this would be a considerable help to anyone running through the book in order to pick out developments missed in the reading of journals.

The service to gas chromatography provided by these Abstracts is excellent, and the editors, abstractors and publishers are to be congratulated on the expedition with which the first two volumes have been produced.

A. MCLEAN

OPTICAL CRYSTALLOGRAPHY. Third Edition. E. E. Wahlstrom. Pp. x + 356. *New York: John Wiley & Sons Inc.; London: Chapman & Hall Ltd*, 1960. 68*s*.

In its third edition this well-known textbook has been completely revised. A new chapter, describing the application of a single-axis stage goniometer to the determination of the refractive indices and optic orientation of crystal fragments, has been added. In view of the generally increasing use of such techniques both in research and teaching the inclusion of this topic is welcome. The chapter also deals with the four-axis universal stage method of examining crystals in thin sections.

In other respects, the general pattern of the book remains as before, although most chapters have been reorganized and partially rewritten. These alterations, together with a considerable number of new diagrams, improve the clarity of the presentation. New work that has appeared since the 1951 edition is incorporated, notably the investigation by Kamb of the isogyres in interference figures, and some references to the original papers appear for the first time. Occasionally the fresh material has been appended rather than assimilated —Wooster's debunking of experiments purporting to demonstrate internal and external conical refraction, for example, is now added without criticism to a section urging precisely the opposite view—but this is not generally so, and the treatment has been kept up to date.

The book has not changed in its presentation of the basic idea of double refraction, the treatment of which is descriptive rather than explanatory, answering the question 'How?' but not 'Why?'. Surely no intelligent student can be satisfied with 'light waves are constrained to vibrate in two mutually perpendicular planes.' Although a complete treatment is not desirable, some attempt at explanation is. There has been no change, either, in the policy of treating the crystal as an anisotropic continuum. A student can still read this book from cover to cover without learning why, on the atomic scale, the refractive index of a crystal should vary with the vibration direction of the light, or why micas are optically negative.

The appearance of the third edition is evidence of the popularity of this book, and it is well-deserved, for the subject is most carefully and soundly presented. Such popularity must, however, depend in part on the lack of

a suitable alternative, for despite the improved typography and layout and excellent diagrams the book is still expensive. The appearance of a smaller and cheaper text of comparable quality might adversely affect the popularity of this one, which contains so much more (and a little less) than most students require, though it will always find a place on the bookshelves of their lecturers.

M. G. BOWN

FLUIDIZATION AND FLUID-PARTICLE SYSTEMS. F. A. Zenz and D. F. Othmer. Pp. x + 513. *New York: Reinhold Publishing Corporation; London: Chapman & Hall Ltd*, 1960. 120*s*.

In this book the authors have endeavoured to summarize and systematize the large body of information relating to solid-fluid systems, particular emphasis being placed upon fluid-particle operations in the process industries and on the pneumatic and hydraulic conveying of solids.

The introductory chapter describes a wide range of processes which lend themselves to a fluidized bed technique, including the catalytic cracking of petroleum, the oxidation of ethylene to ethylene oxide, the production of alkyl chlorides, iron-ore reduction, coal gasification and carbonization, hydrocarbon synthesis and other miscellaneous applications. The unique features of fluidized systems are the continuity of operation, the intimate contact between solid and gas and the ease of temperature control. It is not always, however, that these advantages can be fully realized, and many of the processes described are still in the development stage.

To understand the mechanism of fluidization it is necessary to take account of the static and dynamic properties of powders, the motion of single particles in fluids, the flow of fluids through fixed beds and the methods of specifying particle size and particle size distribution. These aspects of the subject are treated from a fundamental point of view, and excellent summaries are given of the more important recent contributions to them.

One of the most interesting chapters deals with the gravity flow of bulk solids, a subject which, in spite of its practical importance, has hitherto been very much neglected. The flow of granular solids through an orifice is known to depend upon the diameter of the orifice, the bulk density of the solid and some property of the mass which gives a measure of frictional resistance. It is in respect of this latter property that ambiguity exists, and different workers identify it with the angle of repose, the angle of internal friction or the angle of rupture. Other phenomena such as bridging and size separation which occur during gravity flow require further investigation.

The treatment of pneumatic and hydraulic conveying is comprehensive, and deals not only with the development of general correlations for predicting the effects of variation in solid concentration, velocity and particle characteristics on the flow behaviour, but also with some of the practical problems arising from erosion, wall friction and pipe shape.

Considerable space is given to the properties of fluidized beds, including the incidence of fluid and solid circulation, particle carry-over, heat and mass transfer, particle attrition and channelling. Separate chapters are devoted to pressure drop and particle distribution in two-phase flow and bubble formation in fluidized beds.

The concluding chapter describes a generalized fluid-solids flow diagram which enables flow and pressure balances to be made for the three basic vertical-flow conditions found in fluidized systems.

The book is well illustrated, and each chapter is furnished with a comprehensive bibliography. It should prove of value both to the student and to the practising chemical engineer.

D. M. NEWITT

OPTICAL ROTATORY DISPERSION. APPLICATIONS TO ORGANIC CHEMISTRY. C. Djerassi. Pp. xiii + 293. *New York: McGraw-Hill Book Company Inc.; London: McGraw-Hill Publishing Company Ltd*, 1960. 74*s*.

The application of optical rotatory dispersion measurements to the study of organic structures is of relatively recent date (*cf. J.*, 50). This development has been almost entirely the work of one school, that of Professor Carl Djerassi, formerly of Wayne State University, Detroit, and now of Stanford University, California.

This book presents a very thorough and yet at the same time a most readable account of the subject, told in a pleasantly personal style. The greater part of the book is naturally given to Djerassi's own work, which has been largely in the field of steroids, terpenes and similar alicyclic compounds. Chapters on other subjects have been prepared by experts in the fields; these are as follows: instrumentation (A. N. James and B. Sjöberg); theory (A. Moscowitz); polypeptides and proteins (E. R. Blout); and amino acids (J. A. Schellman).

Workers in many fields of natural product chemistry will need no introduction to this work; but others should realize that optical rotatory dispersion is not merely a specialized tool for the steroid chemist and his near neighbours. It has much to offer in any field of organic —or inorganic—chemistry where asymmetric compounds occur.

The technique is being developed rapidly at the moment, and we can be quite sure that when a second edition is called for, it will show how well Djerassi has preached the gospel of optical rotatory dispersion in his papers and in this book.

The production is excellent, and all concerned—author, publishers and printers—deserve a special word of congratulation on the speed with which the book was

produced. It was written in the space of two to three months, and the printers and publishers did their share in little more than six months. For a book of nearly 300 pages, this must be almost a world record today.

W. KLYNE

INSTABILITY CONSTANTS OF COMPLEX COMPOUNDS. K. B. Yatsimirskii and V. P. Vasil'ev. Translated by D. A. Patterson. Pp. viii + 218. *Oxford: Pergamon Press Ltd*, 1960. 42*s*.

This book consists of 83 pages of introductory material, followed by about 120 pages of tables. Complexes with inorganic ligands (in alphabetical order) are listed first, and then the organic ligands are taken in groups (amines, carboxylates, amino acids, diketones and aldehydes, miscellaneous). Each table gives K and pK values, records the experimental method, the temperature and the ionic strength, and is followed by a list of references.

When the book was first published in Russian it broke new ground. The tables must then have been of much value. They have now to be judged by comparison with the tables of Bjerrum, Schwarzenbach and Sillén, published by the Chemical Society in 1957–8. They suffer in being less up to date and far less accurate and complete. To mention an extreme example, Yatsimirskii and Vasil'ev give three references to work on orthophosphate complexes, whereas the Chemical Society tables give more than 40.

The earlier part of the book describes the functions used in analysing the data for step-wise processes of complex formation, the various experimental methods of studying complex formation and how they are employed, and the derivation of thermodynamic constants for complex-forming reactions. The last chapter of this section is a discussion of the factors determining the stability of a complex compound in solution. The description of methods cannot be recommended to the general reader, who would derive from these condensed accounts little idea of the pitfalls in work of this kind. For instance, most of the equations given would apply only under conditions of constant ionic strength, though this is often not stated; moreover the formulae are not all easy to read (in the copy reviewed) owing to uneven inking. The specialist reader, however, is unlikely to be misled by these defects, and for him these chapters may hold much of interest.

C. W. DAVIES

CATALYSIS. VOLUME VII. OXIDATION, HYDRATION, DEHYDRATION AND CRACKING CATALYSTS. Edited by P. H. Emmett. Pp. vi + 378. *New York: Reinhold Publishing Corporation; London: Chapman & Hall Ltd*, 1960. 108*s*.

This book completes an important treatise on catalysis, the first volume of which appeared in 1954; and both Professor Emmett and the individual contributors are to be congratulated on the production of a new major work on this subject.

In the course of this final volume, L. B. Ryland, M. W. Tamele and J. N. Wilson give a good survey of the development of catalytic cracking, with special reference to the production of modern synthetic alumina–silica catalysts having very large internal surface areas. The change in internal structure by ageing is also well dealt with. This is followed by a well-planned section, by M. E. Winfield, on catalytic hydration and dehydration. Reactions of this type are in many cases reversible; and the examples given cover many industrial processes, including the production of butadiene, which is now needed in very large quantities for the manufacture of synthetic rubber. An outstandingly useful part of the section is the long list containing 291 references to the original papers or patents. Chapter 3, written by J. K. Dixon and J. E. Longfield, deals with the catalytic oxidation of hydrocarbons. Of these reactions, the vapour-phase oxidation of benzene to maleic anhydride and of naphthalene to phthalic anhydride have become of special importance by reason of the very large scale on which such oxidations are operated industrially. The catalysts used are, moreover, of great interest on account of the influence of subsidiary components, for example, of tin compounds, both on the yields of acid anhydrides and for the avoidance of the production of intermediate oxidation products such as quinones. The next chapter, by the same authors, covers the oxidation of ammonia and of sulphur dioxide, with a good survey of the two types of catalyst used—platinum gauze, which is usually alloyed with rhodium or other platinum metals, or metallic oxide mixtures—but other processes, such as the synthesis of hydrocyanic acid from methane and ammonia, are also discussed. The remaining two chapters of the book, which deal with the mechanism of catalytic oxidation and with miscellaneous catalytic oxidations, have also been contributed by J. K. Dixon and J. E. Longfield. While these are in general well written, a minor criticism might be made on the ground that the chapters are too short to do justice to the importance of these subjects: thus Chapter 5 contains only 15 pages, and Chapter 6 about a page of text, followed by a two-page table of miscellaneous catalysts and slightly more than a page of references. This, however, in no way detracts from the value of the book.

The acquisition of the complete series of volumes, which has been written by technical and academic authors of considerable distinction, is to be recommended. It supplements and brings up to date works such as the *Handbuch der Katalyse*, which was issued prior to and during the last war, and the more recent series of *Advances in Catalysis*, published by the Academic Press. These three standard works are in themselves an abundant testimony to the great and rapidly growing

importance which catalysis is assuming both in technical and in academic fields.

E. B. MAXTED

ENCYCLOPEDIA OF CHEMICAL REACTIONS. VOLUME VIII. C. A. Jacobson. Edited by C. A. Hampel. Pp. 533. *New York: Reinhold Publishing Corporation; London: Chapman & Hall Ltd*, 1959. $14, 112*s*.

The final volume of this encyclopaedia continues the alphabetical arrangement of the elements, and deals with the reactions of tungsten (143 reactions listed), uranium (153), vanadium (220), ytterbium (31), yttrium (97), zinc (287) and zirconium (148). It also contains over 700 additional reactions of elements dealt with in previous volumes. Lists of the abstractors and the journals used are given, and the indexes to reagents and substances obtained are, as in previous volumes, admirably condensed and complete.

By design, the volume offers no criticism of the reactions: they are merely listed, in a simple and satisfactory order, with their essential conditions and references. As in previous volumes the selection, however, also seems to be uncritical, and the literature of the last thirty years is scantily surveyed. As a result of this incompleteness of compilation the work will be found more useful as a prelude to, than a substitute for, a search through literature.

Nevertheless many readers can attest to the usefulness of the information contained in it, particularly from early journals. The refreshingly modest claim in the preface that users of the work will be more benefited than hampered by its existence will very readily be granted by those who have followed its progress since the first volume appeared in 1946.

D. W. WILSON

ORGANIC CHEMISTRY. A. R. Day and M. M. Joullié. Pp. vi + 864. *Princeton: D. Van Nostrand Company Inc.; London: D. Van Nostrand Ltd*, 1960. 71*s*. 6*d*.

The authors say in the preface that this book 'is designed for a two semester [*i.e.* one year] course in undergraduate organic chemistry, having three lecture hours per week' and the dust-cover describes it as an 'introductory organic chemistry text for the intensive course for chemistry majors.' To cover the material in this book in one year would indeed be an intensive course by British standards and, in fact, there is enough information packed into the 800-odd pages to cover the two-year course leading to Part I of an Honours degree or Grad.R.I.C. in a British university or technical college, and a good deal more besides.

A feature of the book is the parallel treatment of aliphatic, alicyclic, aromatic and heterocyclic compounds. Di- and poly-functional compounds follow their monofunctional analogues. Thus, chapters on alkanes, alkenes, alkynes and dienes are followed immediately by chapters on alicyclic hydrocarbons, aromatic hydrocarbons and unsubstituted heterocyclic compounds. This sequence has much to commend it and is certainly more interesting for the student than the conventional method, whereby the whole of aliphatic chemistry is covered before benzene is mentioned. The treatment of aliphatic and aromatic compounds and of the simpler alicyclic and heterocyclic compounds is thorough and extensive, although surprisingly little space is devoted to petroleum and coal-tar. The coverage of natural products is restricted, inevitably in a one-volume textbook, but there are comprehensive chapters on carbohydrates and on amino acids and proteins, and a chapter entitled 'Natural Products,' which is mainly concerned with vitamins of the B group and other nitrogen-containing compounds. Reaction mechanisms are brought in from the start, rather than being treated as a 'special topic,' and one must hope that this approach is now universal. Stereochemical ideas are also introduced in appropriate places, instead of in a separate chapter, and this too is surely a more natural approach. The last two chapters, 'Metal Carbonyls and Aromatic Metal Complexes' and 'Physical Methods of Determining the Nature of Bonds and Structures of Organic Molecules,' are welcome, although necessarily brief.

It is easy to find points to criticize in any work of this magnitude, and what particular criticisms are made will generally depend on the prejudices of the individual reader. A point which may be confusing to most readers, however, is the use of the symbols + and − both for integral charges and for fractional charges to indicate a polar bond. The alternative use of an arrow for a polar bond is also sometimes confusing, particularly as the arrows denoting reactions are often printed very close to the formulae of reactants which may contain such polar bonds. It is a pity, too, that no yields are given for any reaction, nor is there any indication as to whether one method of preparation for a compound is better than another.

Minor faults include the occasional excessive use of electrons in structural formulae (for example, 24 electrons in the formulae of sulphur trioxide) and the badly drawn melting point – composition curves for racemates on p. 213.

The book is well produced and fully indexed and, although there is room for improvement, the authors are to be congratulated on a major contribution. The reviewer has no hesitation in recommending the book to Honours and Grad.R.I.C. students, and also to research workers and other practising chemists. Whether it is widely accepted here, in the face of much competition, will depend largely on the price, which, although by no means excessive, is still rather high by British standards.

R. E. PARKER

FORMATION AND TRAPPING OF FREE RADICALS. Edited by A. M. Bass and H. P. Broida. Pp. xvi + 522. *New York: Academic Press Inc.; London: Academic Books Ltd*, 1960. 128*s*.

J. W. Moyer remarks in the introduction to this book that surges of research in an older field usually occur because new experimental methods become available or because a utilitarian interest has been aroused. The formation and stabilization of free radicals are no exception. Recently developed powerful physical methods for the investigation of free radicals and atoms include spectroscopic, mass spectrometric and electron spin resonance techniques, and utilitarian interest in radicals has been associated with such things as rocket propulsion, phenomena at the gas–solid interface which occur when rockets enter the atmosphere, photochemistry in the atmosphere at great altitudes, chemistry of interstellar matter and of the solar system, radiation damage and polymerization. In 1956 a three-year research programme on free radicals was begun in the National Bureau of Standards, U.S.A., and much progress has been made there and in some other laboratories with physico-chemical studies of radicals and atoms. The editors and several of the contributors to this book have been associated with the work at the Bureau of Standards. Many substances have been disrupted into radicals in various ways, and the radicals have been trapped at a very low temperature in a matrix of some kind. Even with the powerful physical methods available, the identification of radicals and atoms in the matrix is often uncertain. High concentrations of frozen reactive radicals have not yet been achieved.

In this book eminent contributors give an authoritative account of recent work along these lines. A short history of radical trapping by F. O. Rice shows with interesting quotations how earlier workers have expressed very different views at various times. Radical formation and trapping is reviewed for the gas phase (B. A. Thrush), the solid phase (G. C. Pimentel) and for high-polymer systems (H. Morawetz). Some problems of practical laboratory work with radicals are described by T. M. Shaw, who discusses techniques of electrical discharge in gases, and by F. A. Mauer, who gives an account of low temperature work and the design of cryostats for use with liquid helium. Four articles record the investigation of trapped radicals with different techniques: D. A. Ramsay deals with optical spectroscopy, C. K. Jen with electron spin resonance, H. S. Peiser with X-ray diffraction, and J. W. Edwards with chemical and physical studies.

Trapped radicals may be important in relation to very diverse phenomena, ranging from astrophysical problems, reviewed by B. Donn, to radiation damage, reviewed by R. S. Alger. The evidence for the participation and trapping of radicals in biological processes is discussed by C. H. Bamford and A. D. Jenkins. The difficulties in proposed schemes for using trapped radicals for propulsion seem formidable. M. W. Windsor discusses this problem and other exotic methods for propulsion which might be used in space. J. L. Jackson considers some theoretical aspects of radical trapping. In a final speculative and interesting essay, D. E. Carr discusses the possibility of chemical utilization of trapped radicals, and makes some novel suggestions.

This volume is well produced and has author and subject indexes. Because of the present state of the subject, the book necessarily has somewhat the nature of a progress report, and in this respect it will be of great value to experienced as well as new workers in the field. Perhaps future historians of science will find some fascinating reading in the work.

A. J. B. ROBERTSON

ELEMENTARY TITRIMETRIC ANALYSIS. A. M. G. Macdonald. Pp. viii + 133. *London: Butterworths Scientific Publications*, 1960. 12*s*. 6*d*.

A major difficulty in the teaching of elementary analysis is to decide to what degree the older methods, illustrative of certain chemical principles, may be supplanted by the techniques in modern use—that is, how far analysis should be presented in the light of its true function rather than as an academic exercise.

At school level the appreciation of titrimetric methods is decided by the student's knowledge of general chemistry: hence the uniformity of existing texts. The appearance of this book is to be welcomed, for, without abandoning what is of value in the traditional methods, it introduces a great deal of material which is up to date and comprehensible at the appropriate stage of practice.

A chapter on the maintenance and use of apparatus is followed by a discussion of acid–base titrations and the theory of indicators based upon the Brønsted–Lowry theory. Admittedly, the prerequisites of a good indicator might have been made more clear.

The theory and practice of argentimetric methods and redox reactions are dealt with thoroughly, and the book ends with a chapter on complexometric titrations involving the use of the versatile reagent ethylenediamine tetra-acetic acid (EDTA). The exercises provided here will be of particular interest to scholarship candidates.

The chief criticism which the reviewer would make is of the rather summary initial descriptions for the carrying out of titrations—the procedure for the rough titration is missing—and for the setting out of results. From an examination point of view this is of importance for beginners, especially those who may lack the full-time guidance of an instructor.

However, the book is to be recommended; it is well-planned, free from typographical errors and stoutly bound. It should prove a valuable introduction to the teaching of titrimetric analysis in sixth forms.

H. J. SHEPPARD

THE PERIODIC TABLE. Second Edition. D. G. Cooper. Pp. x + 93. *London: Butterworths Scientific Publications*, 1960. 7*s*. 6*d*.

In the second edition of this useful little book the main body of the text remains unaltered. Brief additions include short notes on 'Fajans' Rules and Ionic Potential' and 'Electronegativity'. At the end of the book sections on occurrence of the elements and on radioactivity and nuclear stability complete the new material. It would be more logical, and at the same time more helpful to the beginner, if a discussion of the periodic classification and electronegativity *preceded* the survey of the elements within the groups. The comparative study in the chapters that followed would then surely have more point. In dealing with the chemistry of osmium an octafluoride is briefly described (p. 55). The existence of this compound is now denied; OsF_6 seems to be the highest fluoride formed by this element. There are some ambiguities of expression; for example, 'Lead only forms a tetrachloride, owing to the instability of tetravalent lead' (p. 22) might well give the wrong idea. In a future edition a little fuller treatment of the halogens would be welcome. The book has been written with the needs of Higher National Certificate students chiefly in mind: its value for grammar school Advanced Level teaching is more debatable.

J. H. WHITE

REACTOR HANDBOOK. Second Edition. VOLUME I. MATERIALS. Edited by C. R. Tipton, Jr. Pp. xv + 1207. *New York: Interscience Publishers Inc.; London: Interscience Publishers Ltd*, 1960. 260*s*.

This edition supersedes the first, published in 1955, and in the Preface it is claimed that the current edition reviews knowledge available in early 1958. This is substantially true, providing the claim is confined to knowledge gained in America, but the coverage given to data obtained and made available by other countries is patchy.

There is no clear statement in the handbook of the kind of technical scientist for whom the data are collected. After five assorted chapters in a 'General' category, the remaining 48 are split among six classes of materials: Fuel, Cladding and Structural, Control, Moderator, Coolants and Shielding; the first two of these occupy two-thirds of the book. This classification and the detailed contents of the chapters show that the *intention* of the book is to provide engineers and metallurgists concerned with the possible use of the various materials in reactors with a selective summary of relevant data and a list of references for more detailed study.

The British reader inevitably tests whether the handbook achieves its intention by examining the data provided that would be of use in designing a carbon dioxide-cooled, graphite-moderated, uranium–magnox fueled reactor of the current C.E.G.B. type. There is no doubt that the data presented in the relevant chapters are poor in quantity and quality. The chapter on graphite contains only one and a half pages on irradiation damage and makes no mention of Wigner energy; the growth data are confined to a single unspecified temperature. Data on the rates of reaction between CO_2 and magnesium or uranium alloys are given in Table 48.5 in the chapter on gaseous coolants without any details of the CO_2 composition, yet in the chapters on uranium and on magnesium it is stated briefly that small amounts of water vapour cause accelerated attack.

The only information on steels that might be used in pressure vessels is confined to a single page (and that in a chapter on special-purpose alloys), dealing briefly with irradiation effects, and there is no mention of the important creep properties. In contrast, 26 pages are devoted to stainless steels. This is but one of many such examples that illustrate how the handbook is biased towards materials important in the U.S.A. Another omission, which is inexcusable, is irradiation creep in uranium; this phenomenon was mentioned in a Russian paper at the Geneva Conference in 1955, and described in some detail by a British author in the normal scientific press in 1956.

These criticisms, pertinent to the data appropriate to this particular reactor system, are not necessarily applicable to other systems. For instance, if one examines data that could be relevant to the British Advanced Gas-Cooled Reactor the handbook is more helpful so far as the fuel elements are concerned. This is undoubtedly due to the earlier American interest in the same materials, namely, stainless steel, beryllium and uranium dioxide. A more cursory examination of other data indicates that where it is appropriate to American reactor systems the range is often extensive.

Despite the omission of desirable data, there is present in this handbook much that should have been omitted. The biggest category is data relevant to the extraction and manufacture of the materials, that is, not only the separate chapters on D_2O–H_2O and zirconium–hafnium separations but also the introductory pages of many other chapters. These manufacturing details are of importance to chemical engineers and extraction metallurgists, but their interests will hardly be served by the rather sketchy approach used in this handbook. It would be preferable to include this material in the future Volume IV, at present covering 'Fuel Reprocessing'. The present volume would be more compact as 'Properties of Materials'.

The method by which the book has been written leads to excessive length and dull reading. Some chapters are clearly the work of a single hand even when several authors are given. Others have been prepared by stitching together the contributions of several individuals with a minimum of editing. If all chapters were of the standard shown in 'Plutonium and Its Alloys', this handbook would have been a delight to

use. Unfortunately too many fall into the category of the two on 'Uranium' and 'Uranium alloys' which, while they undoubtedly contain a vast quantity of useful material, have the pedestrian style and tedious repetition inevitable in a composite article.

The references cited throughout the book show a marked tendency to prefer U.S.A.E.C. reports to other publications more generally available. For instance, if the reader of Table 48.5, mentioned above, wishes to pursue the question of the purity of the atmosphere, he is referred to 'Summary of Symposium on Calder Works Nuclear Power Plant. U.S.A.E.C. Report WASH 409'. The average British reader can only consult U.S.A.E.C. publications in a limited number of places. Though he will be happy to read such publications for American data not otherwise available, it is a distinct disadvantage to be expected to do so for British data available in normal scientific journals or Geneva Conference papers.

The preparation of this handbook under the U.S.A.E.C. auspices has one great advantage. Many times throughout the book data taken from 'classified' U.S.A.E.C. documents are made available. Inevitably the originals cannot be consulted for more detail, but the published snippets in the handbook are very valuable.

In short, this book is written by Americans (there are contributions by 117 American authors, but only one British author) for Americans. Though this is to be expected in a book sponsored by the United States Atomic Energy Commission, it inevitably reduces its value for many British readers. Its purchase can only be recommended to the larger reference libraries or those serving the limited numbers of laboratories and design offices with nuclear commitments.

G. B. GREENOUGH

PUBLICATIONS RECEIVED

NINETY-SIXTH ANNUAL REPORT ON ALKALI, ETC. WORKS BY THE CHIEF INSPECTORS, 1959. Pp. 69. *London*: *H.M.S.O.*, 1960. 4*s*.

REPORT OF THE GOVERNMENT CHEMIST, 1958–59. Department of Scientific and Industrial Research. Pp. iv + 56. *London: H.M.S.O.*, 1960. 3*s*. 6*d*.

SAFETY IN MINES RESEARCH, 1959. Thirty-eighth Annual Report. Pp. 66. *London: H.M.S.O.*, 1960. 4*s*. 6*d*.

REPORT OF THE GOVERNMENT CHEMICAL LABORATORIES, WESTERN AUSTRALIA, 1959. Pp. 28. *Government Printer*, 1960.

NUTRITIVE VALUE OF FOOD-STUFFS AND PLANNING OF SATISFACTORY DIETS IN PAKISTAN. PART I. COMPOSITION OF RAW FOOD-STUFFS. M. I. D. Chughtai and A. Waheed Khan. Pp. 34 *Lahore: Panjab University Press*, 1960. 2*s*. 6*d*.

CLYDE RIVER PURIFICATION BOARD ANNUAL REPORT, 1958–59. Pp. 24. *Glasgow Corporation Printing and Stationery Dept.*

ANNUAL REPORTS ON THE PROGRESS OF CHEMISTRY, 1959. VOLUME LVI. The Chemical Society. Pp. xiv + 476. *London*, 1960.

SCIENCE DATA. J. Newton Friend. Fourth Edition (revised). Pp. viii + 120. *London: Charles Griffin & Co. Ltd.* 12*s*.

TABLES FOR PETROLEUM GAS/OXYGEN FLAMES. Combustion Products and Thermodynamic Properties. I. I. Berenblut and A. B. Downes. Pp. 107. *London: Oxford University Press*, 1960. 30*s*.

ANALYTICAL STANDARDS FOR LABORATORY CHEMICALS AND REAGENTS. Sixth Edition. Pp. 301. *Dagenham: May & Baker Ltd*, 1960.

MEASUREMENT OF NEUTRON FLUX AND SPECTRA FOR PHYSICAL AND BIOLOGICAL APPLICATIONS. Recommendations of the National Committee on Radiation Protection and Measurements. National Bureau of Standards Handbook 72. Pp. vi + 92. *Washington: Government Printing Office*, 1960. 35*c*.

PROTECTION AGAINST RADIATIONS FROM SEALED GAMMA SOURCES. Recommendations of the National Committee on Radiation Protection and Measurements. National Bureau of Standards Handbook 73. Pp. vii + 70. *Washington: Government Printing Office*, 1960. 30*c*.

BRITISH STANDARDS

Annual Report 1959–60. Pp. 282. 7*s*. 6*d*.

1121 : Part 41 : 1960. Methods for the Analysis of Iron and Steel. Lead in carbon steel and low alloy steel. Pp. 6. 3*s*. net.

1428 : Part D 3 : 1960. Specification for Micronitrometer (Pregl Type). Microchemical Apparatus. Pp. 12. 4*s*. net.

1428 : Part B 2 : 1960. Specification for Ammonia Distillation Apparatus (Markham). Microchemical Apparatus. Pp. 8. 3*s*. net.

3161 : 1960. Specification for Sizes of Process Vessels for Chemical and Allied Industries. Pp. 29. 7*s*. 6*d*. net.

3218 : 1960. Test Tubes and Boiling Tubes. Pp. 5. 3*s*. net.

3222 : 1960. Low Compression Set Butadiene/Acrylonitrile Vulcanized Rubber Compounds. Pp. 8. 3*s*. net.

(Obtainable from B.S.I., 2 Park Street, London, W.1.)

Institute Affairs

EXAMINATIONS, JANUARY, 1961

Graduate Membership.—An examination for Graduate Membership, Part I, will be held on Monday and Tuesday, 9 and 10 January, 1961, in London, and elsewhere at the discretion of the Council.

The theoretical section of the examination—Part II(a)—will be held in London, and if required in other centres, on Monday and Tuesday, 9 and 10 January, 1961. The practical section—Part II(b)—will be held in London on Wednesday to Saturday, 11 to 14 January inclusive, and Tuesday to Friday, 17 to 20 January, 1961, inclusive.

Entry forms will be sent as soon as they are ready to accepted candidates. **The last date for the return of Entry Forms is Wednesday, 9 November, 1960.** No entry will be accepted if received after that date.

Diplomas in Applied Chemistry: Branches D and E.—Examinations will be held in the week beginning **Monday, 13 February, 1961**, in London. **The last date for entry is Wednesday, 9 November, 1960.**

NOMINATION AND ELECTION OF DISTRICT MEMBERS OF THE COUNCIL

Fellows and Associates are hereby notified that, for the election of District Members of the Council for Districts in Great Britain and Ireland, to serve from the close of the Annual General Meeting on 21 April, 1961, nominations should be received at the offices of the Institute **on or before Wednesday, 30 November.**

Procedure for the nomination and election of District Members of the Council for Districts in Great Britain and Ireland, referred to in By-law 17(*c*), is prescribed by By-law 30 and by Regulations made thereunder by the Council (*see J.*, 1957, 639).

In accordance with By-law 30(3) a District Member of the Council is elected to serve for **one year**, but under the provisions of By-law 23(*c*) he is thereafter eligible for re-election year by year until he has served as such for **three successive years** (apart from any period of less than one year in filling a casual vacancy).

The Fellows whose names are given below are the present Members of the Council for the Districts indicated. Those whose names are printed in *italics* will have completed three successive years of service on the Council or have otherwise become ineligible for re-election under the provisions of the By-laws or of the Regulations made thereunder.

England

I Walter Wilson, PH.D., D.SC., A.R.C.S., D.I.C.
II Frederick Denison Maurice Hocking, M.SC., M.B., B.S., M.R.C.S., L.R.C.P., A.C.G.F.C., M.I.BIOL.
III *Leonard Powell Priestley*, B.SC., DIP.ED.
IV Reginald Langham Elliott, B.SC., PH.D., F.T.I., F.S.D.C.
V Percy Noel Williams, M.SC.
VI Frederick Cecil Hymas, M.SC.
Samuel Aaron Miller, M.A., B.SC., PH.D.
VII Sidney John Fletcher, B.SC., PH.D., D.L.C.
VIII Carl Christian Skou, M.SC., M.I.CHEM.E.
IX Leonard Balmforth, B.SC.
X *Albert Norman Edmondson*, F.P.I.
XI Richard Eric Parker, B.SC., PH.D.

Wales

I *Sylvester John Herbert Owen Chard*, M.SC., DIP.ED.
II William Rogie Angus, M.A., PH.D., D.SC.

Scotland

I Mearns Bruce Watson, B.SC., PH.D.
II Frank Bell, PH.D., D.SC., F.R.S.E.
III Patrick Dunbar Ritchie, B.SC., PH.D., F.P.I., M.I.CHEM.E., F.R.S.E.

Northern Ireland

William Ford Kirkpatrick, A.H.-W.C., F.I.C.I.

Republic of Ireland

Denis Crowley, M.SC., F.I.C.I.

REGISTER OF FELLOWS AND ASSOCIATES

A new edition of the *Register* is about to be prepared and will contain the names, qualifications, addresses and occupations of all who are Fellows, Associates or Graduate Members of the Institute on 31 October.

Full details of the arrangements were given last month (*J.*, 334), and a shorter statement will be found on page 356.

SPECIAL INSTITUTE LECTURES

Presentation of Meldola Medals for 1959 and Lectures by the Medallists.—At a meeting to be held at the Royal Institution, 21 Albemarle Street, London, W.1, on Wednesday, 9 November at 5.45 p.m., the President of the Institute will present Meldola Medals for 1959 to Dr J. I. G. CADOGAN and Dr T. C. WADDINGTON (*see J.*, 179–180), and this ceremony will be followed immediately by the Meldola Medal Lecture by Dr Waddington, entitled 'Liquid Hydrogen Halides as Ionizing Solvents.' Visitors will be welcome.

By invitation of the Manchester University Chemical Society, Dr Cadogan will deliver his Meldola Medal Lecture entitled 'Recent Developments in Free Radical Addition Reactions' in the Large Chemistry Theatre, University of Manchester, in the previous week—on Tuesday, 1 November, at 4 p.m.

Dalton Lecture.—The Eleventh Dalton Lecture, entitled 'Chemistry in Everyday Life—the Contribution

of the Department of Scientific and Industrial Research,' will be given by Sir Harry Melville, K.C.B., F.R.S., on 28 October at 7 p.m. in the Manchester Town Hall (by kind permission of the Lord Mayor and Corporation of the City of Manchester). The Chairman is Mr E. Le Q. Herbert, *President*, and the Principal Guest will be the Lord Mayor of Manchester, Alderman Arthur Donovan, J.P. Admission is by ticket only, obtainable from the Hon. Secretary of the Manchester and District Section, Mr R. Shackleton, Magnesium Elektron Ltd, P.O. Box No. 6, Lumm's Lane, Clifton Junction, Swinton, Manchester.

Henderson Memorial Lecture.—The Fourth Henderson Memorial Lecture will be given by Dr J. W. Cook, F.R.S., on 12 May, 1961, in Glasgow. The title of the Lecture will be announced later.

MELDOLA AWARD FOR 1960

The **Meldola Medal** is the gift of the Society of Maccabaeans and is normally awarded annually. The next award will be made early in 1961 to the chemist who, being a British subject and **under 30 years of age at 31 December, 1960**, shows the most promise as indicated by his or her published chemical work brought to the notice of the Council of the Royal Institute of Chemistry before 31 December, 1960.

No restrictions are placed upon the kind of chemical work or the place in which it is conducted. The merits of the work may be brought to the notice of the Council, either by persons who desire to recommend the candidate or by the candidate himself, by letter addressed to **The President, The Royal Institute of Chemistry,** 30 Russell Square, London, W.C.1, the envelope being marked 'Meldola Medal.'

The letter should be accompanied by **six copies** of a short statement on the candidate's career (date of birth, education and experience, degrees and other qualifications, special awards, etc., with dates) and of a list of titles, with references, of papers or other works published by the candidate, independently or jointly. Candidates are also advised to forward one reprint of each published paper of which copies are available.

BEILBY MEDAL AND PRIZE 1961

Since 1930, at intervals of one or more years, awards have been made by the Administrators of the Sir George Beilby Memorial Fund, representing the Royal Institute of Chemistry, the Society of Chemical Industry and the Institute of Metals. Sir George Beilby had been President of each of these three bodies, and they jointly sponsored the appeal for subscriptions whereby the Fund was raised as a memorial to him after his death in 1925.

The awards are made to British investigators in science in recognition of independent original work of exceptional merit, carried out continuously over a period of years and involving the development and application of scientific principles in any field related to the special interests of Sir George Beilby, that is in chemical engineering, fuel technology or metallurgy, in their modern interpretations. The awards are intended as an encouragement to younger men and women (preferably under the age of 40) who have done distinguished work of practical significance in any of these fields.

In 1958 two awards, each of 150 guineas, were made. It was then agreed that no further award would be made before 1960 (*see J.*, 1958, 331).

The Administrators have decided that henceforth each award shall consist of a gold medal as well as a substantial sum of money, and shall be known as 'The Beilby Medal and Prize' and specified as being 'For Advancement in Science and Practice.' Such an award will be offered at intervals of two years, but more than one may be made on the same occasion if there are several candidates of sufficiently outstanding merit.

Consideration will be given in due course to the making of an award (or awards) from the Fund in 1961. Outstanding work of the nature indicated may be brought to the notice of the Administrators, either by persons who desire to recommend the candidate or by the candidate himself, not later than **31 December, 1960**, by post addressed to **The Convener of the Administrators, Sir George Beilby Memorial Fund,** The Royal Institute of Chemistry, 30 Russell Square, London, W.C.1.

The letter should be accompanied by **nine copies** of a short statement on the candidate's career (date of birth, education and experience, degrees and other qualifications, special awards, etc., with dates) and of a list of titles, with references, of papers or other works published by the candidate, independently or jointly. Photographic copies of these documents are acceptable. Candidates are also advised to forward one reprint of each published paper of which copies are available.

INSTITUTE PUBLICATIONS

Laboratory Handbook of Toxic Agents.—In 1958, the Publications Committee appointed a Sub-Committee, consisting of Professor C. H. Gray, Dr F. A. Robinson and Dr F. W. Gibbs, to consider the need for a Handbook on Toxicology that would give general information about the toxic hazards associated with the use of familiar chemicals and their acute, chronic and toxic effects.

In his preface, Professor Gray says: 'In planning a book which is intended to be available on the work bench, ready for use in an emergency at any time, the selection of subject matter has necessarily been a major problem. As the various contributors have stressed, the materials considered are restricted to those in general use. Those specific to particular industries, as well as

less common reagents used in research or in small amounts, have been omitted, as well as certain common solvents, the main laboratory hazards of which arise from their inflammability.'

A general introduction to the question of toxicity is given by Sir Roy Cameron, and this is followed by a practical account of precautions and preventions by Dr E. N. Dodd and Mr J. S. Beard. Dr G. D. Muir and Mr W. G. Moss, with the collaboration of Dr Ethel Browning, have contributed the main section of the book, which gives details of over two hundred poisonous and corrosive materials commonly used in industrial, research and teaching laboratories. This section is arranged alphabetically, and is printed in distinctive type on tinted paper. The final section consists of an account by Mr A. Quinton and Miss V. A. Broadhurst of precautions that should be taken when using radioactive materials and sources of ultra-violet and infra-red radiation.

Copies of the book are now available from the Institute or from any bookseller, price 20*s*. One copy will be allowed to each member of the Institute for his private use at the specially reduced price of 15*s*. Order forms for this purpose will be distributed next month.

Training Guide.—A new Institute publication is now available for students and others who desire information on various aspects of training in chemistry. The Guide gives details of qualifications and courses, grants and scholarships, and works-based sandwich course schemes in chemistry. There are also lists of Universities and colleges offering full-time degree courses, as well as particulars of technical colleges that offer full-time, sandwich and part-time courses leading to Grad. R.I.C., Dip.Tech., B.Sc.(external) degree and H.N.D. qualifications in chemistry or applied chemistry. Copies of the Training Guide may be obtained from the Education Officer.

SERVICE BY CHEMISTS TO EDUCATIONAL ESTABLISHMENTS

In May this year a survey was conducted, by means of a form distributed to all corporate members of the Institute resident in the United Kingdom, of the extent to which professional chemists are assisting in the governance of educational establishments. The number of replies received by the end of September was 261, of which 24 were nil returns. A large proportion of the 237 effective replies were from members who serve on more than one committee concerned with education—a few serve on as many as six different committees—with the result that the 237 replies represent service to 390 different committees, excluding those on which the Institute has official representation. About one-third of these (148) show members serving in their personal capacity. The remaining 242 are representatives of industry, universities, local and county education committees, professional and scientific bodies (other than the R.I.C.) or other organizations. In addition it is known that there are 83 representatives nominated by the Institute who serve on committees concerned with further education.

The various types of educational establishments, and the kinds of representation, are shown below.

	Personal Capacity	*Representing an Organization*	*Total*
A. *Schools: Governing Bodies*			
Sec. Grammar ..	16	26	42
Sec. Modern ..	19	17	36
Sec. Technical ..	3	4	7
Comprehensive ..	—	2	2
Public, Indept ..	17	8	25
Church	3	2	5
Primary	2	1	3
Approved	1	—	1
Joint Gov. Bodies	5	20	25
Total ..	66	80	146
B. *Technical Colleges: Governing Bodies*			
National Colleges	1	9	10
C.A.Ts.	5	2	7
Other Technical Colleges ..	11	41	52
Total ..	17	52	69
C. *Technical Colleges: Advisory Committees*			
C.A.Ts	7	13	20
Other Technical Colleges ..	31	63	94
Total ..	38	76	114
D. *Universities: Courts or Governing Councils*	13	9	22
E. *Teacher Training Colleges: Governing Bodies*	2	6	8
F. *Regional Advisory Committees*	7	9	16
G. *Examinations Boards: Advisory Committees*	5	10	15

In addition, the Institute has official representation on committees as follows (*see J.*, 252–3):

Courts of Universities ..	4
National Council for Technological Awards ..	1
Reg. Adv. Council Comm.	16
Governing Bodies of Technical Colleges	13
Advisory Committees of Technical Colleges ..	42
Examining Bodies	7
Total ..	83

It would appear from the returns that the majority of members on school governing bodies, other than those serving in their personal capacity, represent local

or county education committees; most are local or county councillors.

Though the Institute survey may not be complete, it is clear that the number of members assisting in the governance of schools at the present time is small compared with the total number of schools in the country. One would have hoped, for example, that among the governors of the 1250 maintained grammar schools in the country there would be more than 42 professional chemists.

By far the widest representation is found on the advisory committees of technical colleges. In addition to the 42 official Institute representatives on these committees, 114 members serve on one or more of the many college science advisory committees. This is encouraging; but it should be remembered that by no means all technical colleges with science departments have so far established science advisory committees. The number of members who are governors of technical colleges is again small in relation to the total number of colleges.

The 22 representatives on courts and governing councils of universities and their constituent colleges, and the 4 appointed representatives of the Institute, serve only about half the universities in the United Kingdom.

An analysis of returns according to the organizations and institutions represented by members not serving in their personal capacity is as follows:

	No. of Members
Universities	58
Education Committees of Local or County Councils	53
Industry	46
Professional and Scientific bodies (not R.I.C.)	26
Research associations	10
U.K.A.E.A.	6
Nationalized industry (N.C.B.)	4
Min. of Ed., Min. of Agric., Church organizations, Chambers of Commerce, etc.	39
Total	242

PERSONAL NOTES

Honours and Awards

Dr S. K. Mukerjee, *Associate*, lecturer in organic chemistry, University of Delhi, is one of the first commonwealth scholars to take up awards offered by the U.K. under the new Commonwealth Scholarship and Fellowship Plan. He is to carry out research in chemistry at the University of Manchester.

University of Edinburgh.—The degree of D.Sc. was recently awarded to Dr C. T. Greenwood, *Associate*, for physico-chemical studies on polysaccharides; Dr D. J. Manners, *Fellow*, for studies on the structure and metabolism of polysaccharides; and Dr E. E. Percival, *Associate*, for structural studies on algal polysaccharides.

Societies and Institutions

Dr D. C. Garratt, *Fellow*, chief analyst to Boots Pure Drug Co. Ltd, Nottingham, has been elected chairman of the British Pharmaceutical Conference for 1960–61, and will preside at the conference at Portsmouth this month.

Society for Applied Bacteriology. The annual meeting of the Society was held on 5 July at Bangor when the following were elected in the capacities shown: Hon. President, Mr G. Sykes, *Fellow*; Hon. Secretary, Dr E. M. Barnes, *Associate*; Member of Committee, Mr B. M. Gibbs, *Associate*.

Educational

Miss M. Ashworth, *Associate*, has recently been appointed the first headmistress of Hatfield Girls' Grammar School, which opened in September. She was formerly at Nottingham High School for Girls.

Mr T. J. Barnes, *Associate*, has left England to take up a postdoctoral research associateship at the University of Illinois.

Mr B. Cook, *Associate*, has resigned his post of assistant lecturer at the North Staffordshire College of Technology, and accepted a research assistantship in the department of animal nutrition in the University of Illinois.

Mr J. E. Cox, *Associate*, formerly a research chemist with Associated Ethyl Co. Ltd, Ellesmere Port, has taken up a post as science teacher at West Hatch Technical School, Chigwell.

Dr F. N. Fastier, *Fellow*, of the department of medicine, Otago University Medical School, has been appointed Associate Professor in Pharmacology.

Dr D. I. Jenkins, *Associate*, of the department of civil engineering, King's College, Newcastle upon Tyne, has obtained an appointment at the University of California to work under Professor P. H. McGauhey on methods of removing detergents from sewage by modified methods of sewage treatment.

Dr D. M. McAleese, *Associate*, has been appointed lecturer in animal nutrition at University College, Dublin.

Dr T. E. Peacock, *Associate*, has taken up a post as lecturer in chemistry at King's College, London.

Dr D. Peters, *Associate*, formerly of the department of chemistry, Royal Holloway College, has joined the department of physics, University of Chicago, where he will remain for a year.

Mr N. Platt, *Associate*, had resigned his post of Assistant Technical Officer with Imperial Chemical Industries Ltd to take up an appointment as assistant lecturer, Old Swan Technical College, Liverpool.

Dr R. A. Ross, *Associate*, has resigned his post as divisional research leader with Joseph Crosfield & Sons

Ltd, Warrington, to take up a lectureship in inorganic chemistry at the Royal College of Science and Technology, Glasgow.

Dr P. Walker, *Associate*, has returned to this country after spending a year at Harvard University. His new address will be the Dyson Perrins Laboratory, University of Oxford.

Dr S. G. Willimott, *Fellow*, has recently been appointed as a tutor in Hatfield College, Durham Colleges, University of Durham.

Public and Industrial

Dr A. J. O. Axford, *Fellow*, has taken up an appointment as director of research with the Ozalid Co. Ltd, Loughton. He was formerly with Ilford Ltd.

Dr B. P. Bangdiwala, *Associate*, formerly with Atul Products Ltd, Atul, has now taken up a post as works manager and technical adviser of Chemiequip Private Ltd, Bombay.

Mr A. Bird, *Associate*, has left Imperial Chemical Industries Ltd (Dyestuffs Division) to take up an appointment as leader of the chemical engineering department of Lancashire Tar Distillers Ltd, Cadishead.

Mr L. Bretherick, *Associate*, has resigned his position with May & Baker Ltd to take up the post of head chemist and production manager, L. Light & Co.

Mr D. C. Chalmers, *Associate*, has been appointed an intermediate research chemist with Polymer Corporation, Sarnia, Ontario.

Dr M. J. Clancy, *Associate*, has relinquished his post at the Lister Institute of Preventive Medicine, to take up an appointment with the Agricultural Institute, plant sciences and crop husbandry division, Thurles, Co. Tipperary, Republic of Ireland.

Dr A. F. Daglish, *Fellow*, of Ashburton Chemical Works Ltd, has left this country for a period of three years. His new address is c/o Geigy Chemical Corporation, Saw Mill River Road, Ardsley, New York.

Mr H. D. Fowler, *Associate*, has been appointed a senior research officer in the Agricultural Institute, Ireland. His address will be the Agricultural Institute, Johnstown Castle, Wexford, Eire, the headquarters of the soil division.

Mr C. F. M. Fryd, *Fellow*, is shortly leaving Iraq, where he is head of the laboratory, Chemical Directorate, Baghdad. His new address is c/o the Laboratory of the Government Chemist, D.S.I.R., Clement's Inn Passage, Strand, London, W.C.2.

Mr B. Graham-Rack, *Associate*, has recently taken up a new appointment as chief chemist to Armour & Co. Ltd at their Worcester factory.

Mr S. W. F. Hanson, *Fellow*, has joined Armour & Co. (Chicago) as director of food developments, European office. He will work from his home address, Woodland, Hillview Road, Aberdeen.

Mr R. G. W. Hollingshead, *Fellow*, has resigned his position with the Laboratory Chemicals Group, British Drug Houses Ltd, Poole, to take up an appointment with Pfizer Ltd, Sandwich, as a senior technical adviser with the chemical division.

Mr G. B. Hudson, *Associate*, has taken up a post as development chemist with the Du Pont Company of Canada at their Maitland Works. He was formerly at Queen's University, Kingston, Ontario.

Mr E. W. Jackson, *Associate*, has been appointed senior inspector of nuclear installations, Ministry of Power, and has relinquished his post at the Admiralty Research Laboratory, Teddington.

Dr R. S. Jobin, *Associate*, has left this country to take up a technical appointment with the Whakatane Board Mills Ltd, New Zealand.

Dr J. D. Kendall, *Fellow*, has been appointed director of the European research laboratories of the Minnesota Mining & Manufacturing Co. Ltd. He was formerly with Ilford Ltd.

Dr A. M. M. Khan, *Associate*, has left Glaxo Laboratories (Pakistan) Ltd to take up the post of technical director of Pharmapak Laboratories Ltd, Dacca, East Pakistan.

Dr B. R. Mazumder, *Associate*, who has recently been with the food research department of Unilever Ltd, has returned to India. He is now at the Hindusthan Lever Research Unit, Hindusthan Lever Ltd, Hoiji Bunder, Sewri, Bombay 15.

Mr J. Moffat, *Fellow*, has been appointed a director of B.P. Refinery (Llandarcy), B.P. Refinery (Kent) and B.P. Refinery (Grangemouth), all subsidiaries of the British Petroleum Co. Ltd.

Dr V. Oakes, *Associate*, has taken up an appointment with Pure Chemicals Ltd, Liverpool, as chief chemist. He was formerly with Anchor Chemical Co. Ltd.

Dr D. W. Ockenden, *Associate*, has been granted leave of absence from Windscale Works, Cumberland, by the U.K. Atomic Energy Authority to take up a fellowship in radiochemistry at McMaster University, Hamilton, Ontario.

Mr R. A. Page, *Associate*, has resigned his position as technical officer in the research department of Imperial Chemical Industries Ltd (Paints Division) and has accepted appointment as a senior scientific officer with the Home Office Forensic Science Laboratory, Cardiff.

Dr B. C. Platt, *Associate*, has left the Antibiotic Research Station of the Medical Research Council at Clevedon to take an appointment in the research department of the Imperial Tobacco Co. Ltd, Bristol.

Mr P. R. C. Pyle, *Associate*, has recently taken up a post with the Textile Decorative Co. Ltd. Long Eaton. He was works manager of Belfast Silk & Rayon Ltd.

Mr F. N. Reckless, *Associate*, has been appointed chief chemist of Helena Rubenstein Ltd, Toronto.

Dr J. Robinson, *Fellow*, formerly of the federal department of agricultural research, Ibadan, Nigeria, has returned to this country. His new address is

Tunstall Laboratory, Shell Research Ltd, Sittingbourne, Kent.

Mr J. Romney, *Associate*, has been appointed a director of Edwin Cooper & Co. Ltd, a subsidiary company of the Castrol Group.

Mr A. D. Stephenson, *Fellow*, has left Canadian Johns-Manville, Port Union, Ontario, Canada, to take up an appointment with the Federal Government of Canada as a chemical engineer attached to the Truro office of the Public Health Engineering Division, Department of Health and Welfare.

Dr K. L. Sutherland, *Associate*, chief of the CSIRO division of physical chemistry at Fishermans Bend, Victoria, has resigned to take up an appointment as director of research, Colonial Sugar Refining Co. Ltd.

Retirements

Mr J. R. Bruce, *Associate*, deputy director of the University of Liverpool Marine Biological Station, Isle of Man, has retired.

Dr W. M. Hampton, O.B.E., *Fellow*, has retired as managing director, Chance Brothers Ltd, Smethwick, but will remain on the board. He will also continue as chairman of the British Glass Industry Research Association.

Dr J. I. M. Jones, *Fellow*, has retired after 22 years as technical manager and director of research of Crookes Laboratories Ltd.

Dr R. H. Marriott, *Fellow*, has retired from County Laboratories Ltd (Beecham Group) after 20 years' service.

Dr A. Proven, *Associate*, retired from Imperial Chemical Industries Ltd at the end of September.

Dr J. Sword, *Fellow*, chief chemist of the flour and allied departments of the Scottish Co-operative Society Ltd, has retired after 30 years' service.

Dr A. F. Watson, *Fellow*, has recently retired from his post as research biochemist, Evans Biological Institute, Runcorn.

LONDON POPULAR LECTURES

The London Section is embarking on a new venture, starting in the 1960–61 season. A series of popular lectures on subjects to which chemists have made important contributions is being arranged. The lectures are intended for intelligent adult audiences with no special scientific knowledge, but they should also be of interest to students and trained chemists.

Lectures so far arranged include 'Modern Colour Photographic Processes' by Mr R. B. Collins at the Goldsmiths' College on 26 October at 7 p.m., and 'Detergents' by Dr K. G. A. Pankhurst at Hendon Technical College on 29 March, 1961, at 7.30 p.m.

Section Activities

MANCHESTER AND DISTRICT

Ashburton Chemical Works Ltd. On the afternoon of 16 September, 18 members visited the Ashburton Chemical Works. First they were given a short lecture on the ramifications of the Geigy Company in general and the Ashburton Chemical Company in particular. The tour round the plant included the inspection of the large-scale production of sebacic acid from castor oil, as an example of one of the Ashburton Chemical Company's preparations. The visitors were also shown round the new office block, laboratories and the very modern steam-raising and generating plant. From the top of the new building, they saw an exciting although not very beautiful view of Trafford Park.

After the visit, members were entertained to tea and sandwiches in the canteen, and a vote of thanks was proposed by Mr R. Shackleton to Dr Buchmeier, who made the visit possible, and to Dr Pieth, Dr Hook and Mr Buckley who had so ably acted as guides. Mr Shackleton pointed out that after this very interesting visit one thing at least that members of the Section had learned was that castor oil had uses other than in the home.

CEYLON

The Section is continuing to hold regular meetings with the Ceylon Chemical Society. Close collaboration is maintained with the Ceylon Association for the Advancement of Science and the Institute of Scientific and Industrial Research. Two members of the Section, Dr M. U. S. Sultanbawa and Dr R. O. B. Wijesekara, represented Ceylon at the IUPAC International Symposium on the Chemistry of Natural Products, held in Australia in August.

DECCAN

Mildew in Cotton Textiles. At a meeting held on 6 September in the General Chemistry Lecture Hall of the Indian Institute of Science, Bangalore, Dr B. G. S. Acharya, managing director of Garutman Industries (Private) Ltd, Bangalore, spoke on 'Mildew in Cotton Textiles'. Mr R. Ramaswamy presided.

Dr Acharya described the conditions under which cotton textiles are generally attacked by micro-organisms commonly known as mildew during storage in the manufacturing premises, and discussed the use of certain chemicals in the control of the organisms.

The microbial activity which commences on the surface of textiles under favourable conditions of moisture and temperature, if not controlled, extends downwards to cause 'rot' and severe damage to the material. The micro-organisms involved in this process of decomposition and destruction include fungal forms such

as *Aspergillus niger*, *Chaetomium globosum*, *Rhizopus nigricans*, *Memnoniella echinata*, *Pullularia pullulans* and *Helminthosporium* sp., and bacteria such as *Bacillus subtilis*.

Zinc chloride is widely used as an antiseptic in cotton textiles. Its use in the textile industry in India was, however, limited during World War II as the import of this chemical was very much restricted. It then became necessary to find a suitable substitute for zinc chloride. Various chemicals, both organic and inorganic, were tried, and their antiseptic properties were compared with that of zinc chloride by treating aqueous suspensions of mixed cultures of the fungi mentioned above with the chemicals.

Some of the compounds which were found to have very high anti-mildew effects are pentachlorophenol and its sodium salt, salicyl anilide, *o*-hydroxydiphenyl and its sodium salt, dichlorophene and sodium silicofluoride. The mode of action of these compounds was also briefly considered.

After a valuable discussion, Dr S. C. Pillai proposed the vote of thanks.

EASTERN INDIA

Role of Chemistry in Forensic Work. On 9 March, a symposium on this subject was held jointly with the Institution of Chemists (India) in the Conference Room of the Department of Serology, Government of India, Calcutta. Dr K. N. Bagchi, a Vice-Chairman of the Section, who presided, welcomed members and visitors in his inaugural address and stressed the importance of such a symposium, particularly when forensic science laboratories were being established in various States of India. Eight speakers participated and presented 10 different papers.

Four papers were contributed by members of the staff of the Central Forensic Laboratory, Calcutta. The first paper, entitled 'Estimation of the time of Death by Biochemical Methods', was presented by Dr N. K. Iyenger. He discussed briefly the general principles of usual methods for ascertaining the time of death and mentioned the factors likely to affect the accuracy of results. Finally he reviewed the more recent procedures involving analysis of cerebrospinal fluid and blood of the victim. The second paper, on 'Spectroscopy in Forensic Science', was read by Dr S. N. Garg. After indicating a broad outline of the general spectroscopic method of analysis, including both emission and fluorescence absorption spectroscopy, the speaker dealt with procedures particularly suitable for substances usually encountered in forensic investigations. The subject of the third paper, presented by Mr B. K. Dutta Roy, was 'The Chemical Examination of Firearms and Explosives'. He gave an account of the importance of analysis of the products of explosion left in the barrel, the bullet itself, and the partially burnt powder obtained from the muzzle and/or clothing of the victim in affording evidence from the forensic point of view. He further described briefly the methods of analysis of bombs, crackers and certain types of fireworks. Dr S. Chowdhury, who contributed the next paper on the 'Role of Chemistry in Forensic Biological Techniques,' gave an interesting review of some of the biological techniques for identification of trace materials commonly met with in criminal investigations. These techniques included histochemical analysis of the mutilated parts and chemical and microchemical examinations of biological substances, such as hair, blood, semen, saliva and other excreta.

Dr D. K. Ghoshal (Laboratory of the Serologist, Calcutta), presented the fifth paper, entitled 'Determination of Choline in the Detection of Seminal Stains.' The speaker dealt with a comparative study of the usual microscopic procedure for detecting spermatozoa in seminal stains and the simple Florence test. He then read another paper, on 'Identification of Seminal Stains by Acid Phosphatase Reaction', submitted jointly with Dr B. N. Ghosh and Mr A. K. Chowdhury. The method of identification of seminal stains based on determination of acid phosphatase was discussed in detail, and it was claimed that a high degree of positive correlation existed between this method and others involving identification of spermatozoa.

Dr N. K. Sen (State Forensic Laboratory, Calcutta), gave an interesting paper entitled 'Chemical Examination of Questioned Documents'. After explaining the term 'questioned documents', he gave a short account of the importance of chemical and microscopic examinations of documents, inks, pencil pigments and stains in ascertaining authenticity as well as age of the document. Dr Sen then discussed the estimation of the age of writing, comparison of ink writing, reconstitution of the erased text and examination of charred documents. Finally he dealt with the analysis of ink by paper electrophoresis and paper chromatography.

Dr N. Ghatak (Department of The Chemical Examiner, Agra) read the eighth paper, 'Examination of Explosive Materials and Products of Explosion', which was submitted jointly with Dr B. N. Dey. He discussed the nature, classification and analysis of explosive substances and the products of explosion. It was pointed out that the majority of the high explosives (organic nitro compounds) did not leave any residue behind, but an idea of the parent explosive could be obtained from the nature of explosion as well as from the physical examination of the missiles projected.

The last two papers were presented by Dr A. R. Natarajan (State Forensic Science Laboratory, Madras). In the paper entitled 'Toxicology of the Organo-Phosphorus Compounds' he spoke on the chemistry of a large number of organo-phosphorus compounds, which are the best insecticides known. After indicating the manner of their absorption in the system, he discussed their physiological functions, toxicology and

prophylaxis. He then discussed in detail the isolation, identification and estimation of folidol. In the other paper, on 'Role of Chemistry in Forensic Work (Microchemistry)', Dr Natarajan gave a lucid account of the importance of microchemistry in analysing minute quantities of substances generally met with in forensic investigations.

Each paper was followed by an interesting discussion. Summing up, Dr Bagchi pointed out the vast potentialities of scientific techniques in the investigation of crime, and made a short speech of thanks to the speakers.

NORTHERN INDIA

Annual General Meeting. The A.G.M. of the Section was held on 10 September in the Chemistry Lecture Theatre of the University of Delhi. Professor T. R. Seshadri, F.R.S., presided. He placed before the meeting a proposal discussed by the Sectional Committee to institute study groups to study the process of application of chemistry to the advancement of economic growth of India. Dr B. Viswanath was requested to advise the Section in this matter.

After presentation and adoption of the Annual Report for 1959-60 and the statement of accounts, elections were held for officers and members of committee. The following were elected: Chairman, Professor T. R. Seshadri, F.R.S.; Vice-Chairman, Professor R. B. B. Viswa Nath; Hon. Secretary and Treasurer, Dr S. Neelakantan; Hon. Auditor, Dr G. S. Saharia; Members of Committee, Drs K. B. L. Mathur, S. Raychaudhuri, G. S. Saharia, H. A. Shah and T. A. Venkitasubramanian, and Mr N. Prabhakara Rao.

Dr H. C. Gaur, lecturer in chemistry, University of Delhi, then gave a lecture on 'Impedance measurements in fused-salt media.' He described measurements that were carried out in moltex eutectic potassium chloride–lithium chloride (41·2 : 58·8 mole per cent) at 450 $\pm$ 2°C. The method of preparation of the solvent was given. The theory of the impedance method of studying kinetic parameters in the reduction of metal ions was discussed in detail and the results of its application in the reduction of Pb^{++}, Zn^{++}, Cd^{++} and Co^{++} were presented. In all the cases amolous faradaic impedance due to adsorption of ions at the electrode was observed, which had to be corrected. The reduction of Pb^{++} and Co^{++} proceeded with immeasurable rate; exchange current values for the reduction of Cd^{++} and Zn^{++} were found to be 10^{-2} and $2{\cdot}4 \times 10^{-2}$ amperes for the electrode area (0·0013 cm^2) employed.

Members and guests were entertained to tea before the meeting. After the lecture the Chairman proposed the vote of thanks.

News and Notes

AWARDS AND COURSES

Harkness Fellowships.—Thirty Harkness Fellowships of the Commonwealth Fund are offered for 1961 to British subjects holding degrees of U.K. universities or equivalent professional qualifications. The tenure of the Fellowships is from 12 to 21 months in the United States. No formal age limits are set. The closing date for applications is 1 December. Further information may be obtained from the Warden, Harkness House, 38 Upper Brook Street, London, W.1.

F. Stanley Kipping Memorial Fund.—It has recently been announced that the appeal launched in 1952 to industry and colleagues and past students of the late Professor F. S. Kipping, F.R.S., who occupied the chair of chemistry in the University College, Nottingham, for 40 years, yielded £7,446. This was used in 1956 to found the F. Stanley Kipping Research Scholarship. Four scholarships have so far been awarded; these have been supplemented by grants from the Ministry of Education.

Courses dealing with Corrosion.—The Education Panel of the Corrosion Group of the S.C.I. has prepared a revised summary of undergraduate and postgraduate courses including corrosion topics to be held by universities and technical colleges this session. The summary, which also gives details of facilities for research work and the main subjects studied, is available from the Hon. Secretary of the Panel, Mr W. D. Parker, Winn & Coales Ltd, Denso House, Chapel Road, London, S.E.27.

Sandwich Courses.—The latest *List of Sandwich Courses* published by the Ministry of Education (List 182: H.M.S.O., 4*s.* net) gives details of more than 330 sandwich courses and 40 block release courses that are being offered by technical colleges this session. Of the sandwich courses 34 are in chemistry or applied chemistry.

Short Courses.—Details of short advanced courses in science and technology, to be held in the 1960–61 session, are contained in the annual publications of the various Regional Advisory Councils. Bulletins that have been received so far are: *Bulletin of Special Courses in Higher Technology*, London and Home Counties Regional Advisory Council for Technological Education, Tavistock House South, Tavistock Square, London, W.C.1 (Part I: Autumn Term, 3*s.* 6*d.*); *Short Advanced Courses in Higher Technology*, West Midlands Advisory Council for Further Education, 161 Corporation Street, Birmingham, 4 (*gratis*); *Special Advanced Courses*, Northern Advisory Council for Further Education, 5 Grosvenor

Villas, Grosvenor Road, Newcastle upon Tyne, 2 (*gratis*); *Specialised and Advanced Short Courses for Scientists and Technologists*, Yorkshire Council for Further Education, 52 Upper Basinghall Street, Leeds, 1 (*gratis*); *Directory of Institutions and Courses in Technology, Commerce, Art and Agriculture*, East Anglian Regional Advisory Council for Further Education, County Education Office, Stracey Road, Norwich, Norfolk (*gratis*); *Bulletin of Advanced and Special Courses*, Regional Advisory Council for the Organisation of Further Education in the East Midlands, 12 King John's Chambers, Bridlesmith Gate, Nottingham (1*s.* post free); *Bulletin of Special Short Courses*, Regional Council for Further Education for the South West, 12 Lower Castle Street, Bristol, 1 (*gratis*).

MEETINGS AND CONFERENCES

Combustion Research Colloquia.—The department of chemical engineering, Imperial College of Science and Technology, has arranged a series of six colloquia for the Autumn Term, to which visitors are welcome. The first two, to be held at 4 p.m. on 17 and 24 October, will consist of a report on the 8th International Symposium on Combustion and on aspects of Combustion research in the U.S.A., to be given by Dr F. J. Weinberg and Dr A. G. Gaydon, respectively.

Food Science and Technology.—The First International Congress of Food Science and Technology will be held in London on 18–21 September, 1962. The following officers have been appointed: President, Lord Rank of Sutton Scotney, J.P.; Executive Committee, Professor H. D. Kay, C.B.E., F.R.S. (chairman), Dr A. J. Amos (chairman, publications committee), Dr E. C. Bate-Smith (chairman, scientific programme committee), Mr A. P. Buchanan (chairman, transport and visits committee), Dr J. B. M. Coppock, O.B.E., Mr F. J. Monkhouse (chairman, finance committee), and Lt-Col F. J. Griffin (hon. secretary).

The scientific programme, divided into two sections, will cover every aspect of food science and technology, including chemical, physical, biological, microbiological, quality, analysis, composition, engineering and presentation factors, food and the consumer, and training of food scientists and technologists. From within this wide area topics will be selected on the basis of their novelty, timeliness and breadth of interest.

Institute of Fuel.—The second conference on waste heat recovery, entitled 'Waste Heat Recovery from Industrial Furnaces' will be held in Bournemouth on 15–19 May, 1961. It is intended to bring up to date the book *Waste Heat Recovery from Industrial Furnaces* (Chapman & Hall Ltd) which resulted from the first conference held in April, 1946. Further information may be obtained from the Institute of Fuel, 18 Devonshire Street, Portland Place, London, W.1.

Institute of Metal Finishing.—This year a Dinner will be held on the day of the Annual General Meeting and the Hothersall Memorial Lecture (5 December) at the Café Royal. Although the business meeting and lecture will precede the dinner, it is intended that the dinner itself shall be a social event, and members' ladies and guests will therefore be welcomed. It is hoped that this function, which it is planned to hold annually, will become one of the most popular in the calendar. Further details may be obtained from the Hon. Secretary, Dr S. Wernick, 32 Great Ormond Street, W.C.1.

A symposium on Nickel-Chromium Plating will be held by the London Branch at the Royal Festival Hall on 16 November, starting at 9.30 a.m. Tickets, price 37*s.* 6*d.* each, may be obtained from the Hon. Treasurer of the London Branch, Mr S. W. Baier, 9E Cleveland Road, London, W.13.

Institute of Physics.—A conference on statistical mechanics (with special reference to irreversibility), to be held at Queen Mary College on 19–20 December, is being arranged by the Institute of Physics and the Physical Society. Topics include the general theory of irreversibility, random processes, liquids (theory and experiment) and irreversibility in gases and plasma. Further information and preliminary programmes can be obtained from the Secretary, 47 Belgrave Square, London, S.W.1.

Macromolecular Chemistry.—An International Symposium on Macromolecular Chemistry, under the patronage of IUPAC and the Canadian High Polymer Forum, will be held in Montreal from 27 July to 1 August, 1961. It will embrace all aspects of high polymer science, with special emphasis on the newer fields of research. Further details may be obtained from the Organizing Committee, P.O. Box 816, Sarnia, Ontario, Canada. Other meetings to be held in Canada at this time include the Annual Conference and Exhibition of the Chemical Institute of Canada (3–4 August) and the IUPAC Conference and Congress, 1961 (2–12 August).

Metallic Corrosion.—The First International Congress on Metallic Corrosion will take place in London on 10–15 April, 1961. It will be opened on the afternoon of 10 April by its president, Sir Harry Melville, K.C.B., F.R.S. Plenary lectures will be given on the next four days by Professor Y. M. Kolotyrkin (U.S.S.R.), Professor P. Lacombe (France), Professor H. H. Uhlig (U.S.A.) and Dr U. R. Evans (U.K.).

Representatives of 10 countries have been appointed Vice-Presidents, that from the U.K. being Dr W. H. J. Vernon, O.B.E. On the afternoons of 11 and 13 April a variety of visits to laboratories and industrial organizations will take place. Rather less than 100 papers, emanating from 18 countries, will be presented.

In collaboration with the organizers of the Congress the Science Museum is arranging a Corrosion Exhibition, mainly of historic interest. Social events include receptions and a banquet. An attractive programme for the ladies is being arranged by a Ladies' Committee under the chairmanship of Lady Melville.

Further details will be announced in due course.

Natural Resources in Scotland.—A three-day symposium on this subject has been arranged by the Scottish Council (Development and Industry). It will take place from 31 October to 2 November in the rooms of the Royal Society of Edinburgh, and fifty papers will be presented for discussion. The Council has received strong support from the Scottish Office Departments, universities, colleges, industrial companies and individuals in the preparation of the papers and in the organization of the symposium. It is intended that the symposium shall form a fact-finding group from which should come pointers to future action of advantage to the Scottish economy as a whole. It is expected to be the first step in an enquiry which may last four years and lead to a change in attitude towards Scottish natural resources. Topics include soil, minerals, fish and wildlife, fuel and energy, utilization of minerals, and research and development techniques.

Tennant Memorial Lecture.—The Society of Chemical Industry announces that Professor A. R. Ubbelohde, F.R.S., Professor of Thermodynamics, Imperial College of Science and Technology, will deliver the Fifth Charles Tennant Memorial Lecture, entitled 'Melting and Freezing' in Room 24, Royal College of Science and Technology, George Street, Glasgow, on 4 November at 6 p.m.

Chemistry Summer School 1960.—Thirty heads of departments and lecturers from technical colleges attended the Ministry of Education Chemistry Summer School at Bristol from 12 to 21 July. The programme was devised mainly to promote understanding of the present industrial outlook and to give an opportunity of seeing and discussing processes in operation on chemical plants.

The National Smelting Co. Ltd, British Cellophane Ltd and Bristol and West Tar Distillers Ltd co-operated with the Ministry of Education to provide specialist lectures on the science and technology of selected processes before visits were made to the works; they also arranged talks on more general topics, including organization, instrumentation, costing and accounting, and safety.

The College of Science and Technology, Bristol, received the Summer School on two days, and evening sessions were addressed by Dr F. N. Woodward, C.B.E., director of the Arthur D. Little Research Institute, on 'International collaboration in research,' and by Dr H. S. Hirst, general manager of the Severnside Works of Imperial Chemical Industries Ltd, on 'The selection and development of a new chemical factory site.' At their final meeting the members of the School urged the Ministry to provide comparable facilities in 1961.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The 122nd Annual Meeting was held in Cardiff from 31 August to 7 September under the Presidency of Sir George Thomson, F.R.S. and was attended by more than 4,000 members. The President of the Chemistry Section was Dr James Taylor, M.B.E., *Fellow* (photograph below), who took for his Presidential address the theme that 'Chemistry is not enough'. Dr Taylor

Dr James Taylor, President of the Chemistry Section

referred to the contributions of chemists to the improved standard of living and to the 'good life' but suggested that chemists, in common with other scientists, had much to contribute to the wider aspects of business and commerce as well as to the broad field of politics and world affairs. He looked forward, in fact, to the day when the Minister for Science would be a scientist.

One of the main sessions of the Chemistry Section was devoted to current work on polymer chemistry. This session was under the chairmanship of Professor C. E. H. Bawn, C.B.E., F.R.S. and included papers on 'Some new stereoregular polymers' by Mr P. R. Thomas, *Associate*, 'The graft polymerization of styrene on to pre-irradiated polythene,' by Dr T. T. Jones, *Associate*, 'Modern aspects of polymer structure and its relation to properties' by Mr J. L. B. Benton and 'The mechanism of polymerization reactions catalysed by ionic catalysts' by Professor A. G. Evans, *Fellow*. Another session was devoted to the silicones, when Dr R. A. Gregory, *Fellow*, on 'The commercial production of silicones' and Dr J.

Bell on 'The industrial application of silicones' were among the contributors. At a shorter session there were two papers on the technical and commercial development of a new product. Polythene was taken by way of example of the technical development of a new product, and the paper was given by Dr E. Hunter, *Fellow*; the subject of epoxide resins was chosen by Mr P. J. March, *Fellow*, for illustrating the commercial development of a new product.

Among the 12 excursions organized by the Chemistry Section were visits to Midland Silicones Ltd, Monsanto Chemicals Ltd, Pilkington Bros (South Wales) Ltd, as well as a visit (traditional for chemists) to a local brewery. Each of the other 14 sections of the British Association also had full programmes of lectures and visits.

Apart from the sectional meetings the main theme of the B.A. meeting this year was world food and population. A whole day was devoted to a symposium on this theme, when the problem of feeding the world with its rapidly increasing population was examined, with special reference to the part that science can play in the production of more and better food. The urgency of the food and population problems and the present inequalities of food production in different regions of the world were emphasized by means of statistical charts arranged by the Food and Agricultural Organization of the United Nations as part of an exhibition staged in conjunction with the symposium. The importance of chemical fertilizers and other chemical aids to husbandry and the general impact of investment capital on the standard of living and food production in developing countries were illustrated in exhibitions arranged by Imperial Chemical Industries Ltd and Unilever Ltd. The estimated impact of the Kariba Dam project on the standard of living in Rhodesia was depicted in an exhibit prepared by the office of the High Commissioner for the Federation of Rhodesia and Nyasaland.

In addition to the sectional meetings and excursions and the symposium on world food and population there were many other general excursions, scientific films and social events including receptions by The Lord Mayor and Corporation of Cardiff, the National Museum of Wales, and the President and the Council of the University College of South Wales and Monmouthshire. There was also an orchestral concert given by the B.B.C's Welsh Regional Orchestra.

A special programme for young people in the Cardiff area was arranged in co-operation with the Schools Advisory Committee and the Local Committee of the British Association. This included a 'Science in Schools' Exhibition and a 'Brains Trust' under the chairmanship of Mr Percy Cudlipp, Editor of *The New Scientist*. Among the panel of scientists on the Brains Trust was Dr I. J. Faulkner, *Fellow*, who was also Recorder of Section B: Chemistry.

HANDBOOK FOR CHEMICAL SOCIETY AUTHORS

The Chemical Society has recently issued a comprehensive handbook for authors, price 21*s*. The contents are best indicated by the chapter headings: (1) The Presentation of Papers; (2) Inorganic Nomenclature: I.U.P.A.C. Rules; (3) Organic Nomenclature: I.U.P.A.C. Rules; (4) Steroids; (5) Carbohydrates; (6) Organophosphorus Compounds; (7) Physicochemical Symbols; (8) Spectroscopic Data; (9) Crystallography; (10) Collated Editorial Reports on Nomenclature 1950–1959; (11) Abbreviations of Journal Titles. Most of this material has been published before, but it is now collected into one volume for the first time.

The editors state in the preface that the 'object of this Handbook is to present, in one place, as much as possible of what an author writing for the Chemical Society may require to know.' There is no doubt that this object has been admirably attained, and the book will be warmly welcomed by all authors and intending authors. The only serious criticism is that, for a subject as complex as chemical nomenclature at the present time, the index is far too small, and it is to be hoped that an opportunity will be taken to rectify this in a second edition. One sincerely hopes, too, that the nomenclature adopted by the Chemical Society, and widely accepted as standard in Britain, will now at last achieve some degree of permanence.

R. E. PARKER

G.C.E. Advanced Level Examination.—Important changes in the Advanced level examination for the G.C.E. are recommended in a Report of the Secondary School Examinations Council (*The General Certificate of Education and Sixth Form Studies*, H.M.S.O., 2*s*. 6*d*. net). The changes suggested are designed to help relieve the pressure on sixth forms and to make the examination more useful to the universities and other selectors.

The S.S.E.C. recommend the introduction of a system of grading at the Advanced level with five main grades of pass: Grade 'A', accounting for about the first 10 per cent of Advanced level entries in a subject; Grade 'B', accounting for the next 15 per cent; and Grades 'C', 'D' and 'E' together accounting for a further 45 per cent. The standard of the Advanced level pass would remain unaltered. The two highest grades might be regarded as evidence of a candidate's suitability for a University honours course or course of equivalent standard. In addition, there would be two supplementary gradings for abler candidates, called 'Distinction' and 'Merit', awarded on the result of special or 'S' papers, which would be designed to test a candidate's intellectual grasp and capacity to think about his subject.

The essential advantage of the scheme is that, without requiring a major change in the existing structure of the

G.C.E. examination, it would provide more precise and relevant information about the range of ability of candidates above the Advanced level pass, and would, it is hoped, be of greater assistance to University selectors, enabling them to make their selection without having recourse to numerical marks. At the same time the schools will still have, in the basic papers, a test suitable for sixth form leavers not aiming at University.

This Report is issued ten years after the G.C.E. examination was first introduced. Subject entries at the Advanced level have increased during this period from 103,800 in 1951 to 184,500 in 1959, and they are expected to reach 350,000 in 1965.

Jordan Laboratory.—On 21 September, Mr E. B. Calvert, chairman of the Paint Manufacturers' Joint Executive Council, officially opened the Jordan Laboratory, an extension to the Paint Research Station, Teddington, of the Research Association of British Paint, Colour and Varnish Manufacturers. At the ceremony a plaque was unveiled to commemorate the service of the Founder-Director, Dr L. A. Jordan, C.B.E.

S.A. Parliamentary and Scientific Society.—The inaugural meeting of the Society was held in Cape Town on 26 February, when 13 Senators and Members of Parliament, three Members of the Provincial Council and 42 scientists were present. Cape members of Council of the South African Association for the Advancement of Science were congratulated on their initiative in forming the Society. There was a smaller attendance at the second meeting on 30 April, and it was suggested that future meetings should be held at or near the beginning of the Parliamentary Session.

Monsanto Chemical Company.—Monsanto Overseas S.A., a wholly owned subsidiary of Monsanto Chemical Company, St Louis, U.S.A., has formed a Spanish company jointly with Aiscondel S.A., Barcelona. The new company, Monsanto Iberica S.A., is one of the first companies to be formed under the recent Spanish law which permits up to 50 per cent ownership by foreign companies. The company already operates a plant near Barcelona, producing plasticizers, stabilizers and lauroyl peroxide for the plastics processing industry. A new plant, expected to come into operation in the second half of 1961, is to be constructed at Monzon to make calcium carbide, acetylene and various derivatives.

Titanium Oxide Plant.—Construction work has started on the titanium oxide plant being built at Umbogintwini on the Natal Coast, South Africa, by South African Titan Products (Pty) Ltd, a company formed by British Titan Products Co. Ltd and African Explosives & Chemical Industries Ltd. This plant is expected to be completed by the beginning of 1962, will have a capacity of 10,000 tons per annum and will cost approximately £3,000,000.

Correspondence

NEW GRADES OF MEMBERSHIP

SIR,—May I, as one who has obtained his A.R.I.C. (by part-time study) in recent years, be permitted to reply to Mr Blau?

Frankly his comments astounded me; his assertion that he and his contemporaries could 'pass with ease' the old A.R.I.C. examination savours so much of sour grapes that personally I would never have dreamed of putting it into print. To excuse one's lack of academic ability by saying 'If only I had been born *x* years earlier' is to my mind simply an easy way out, and this is, I suspect, what Mr Blau is looking for in the new L.R.I.C diploma.

I sat for the examination in 1955 and comparison of papers then and recent papers confirms that the standard is essentially the same, namely, Very High!

Come, Mr Blau, by all means let us have an L.R.I.C. status but do not belittle the achievements of your predecessors by trying to split the A.R.I.C. examination into 'old' and 'new' and equating the old with the proposed L.R.I.C. diploma.

S. WILLIAMS,
Associate
3 North Way,
Holmes Chapel,
Nr Crewe, Cheshire

LABORATORY RISKS AND SAFEGUARDS

THE ELIMINATION OF ORGANIC ACIDS DURING QUALITATIVE INORGANIC ANALYSIS

SIR,—A hitherto unforeseen hazard in qualitative inorganic analysis has been brought to the attention of the Midlands Association for Qualitative Analysis by the research and development department of Imperial Chemical Industries Ltd, Nobel Division. It appears that during practical instruction in qualitative analysis in their laboratories a minor explosion occurred on evaporation to dryness with nitric acid of the solution obtained from the traditional Group 2 (copper–tin group). The crucible used for the evaporation was shattered. The material for analysis contained sodium salicylate and lead carbonate, and was being examined by the traditional scheme of analysis.

This explosion appears to have occurred as a result of the following sequence of operations. The mixture was dissolved in hot dilute hydrochloric acid and this hot solution was treated directly with hydrogen sulphide to precipitate the copper–tin group metals. After removal of the precipitate, the solution was evaporated to dryness in a crucible with nitric acid, when the explosion occurred. This probably resulted from the conversion of salicylic acid to picric acid during the evaporation, and the formation and detonation of lead

picrate in the dry residue. This is supported by the fact that lead and an aromatic nitro-compound were found as a yellow film on the fragments of the crucible.

Our interest in this hazard relates mainly to the possibility of a similar explosion occurring during the use of the M.A.Q.A. Advanced Analysis Tables,[1] and certain tests were carried out in order to ascertain whether this hazard was a general one, inherent in the commonly used schemes of analysis, or one resulting from the particular conditions used for the analysis of this particular combination of ions.

In the M.A.Q.A. scheme there is no possibility of lead remaining in solution after precipitation of the copper–tin group; even if lead is not removed as chloride (as was apparently the case in the analysis described above), the bulk of it is removed as lead sulphate along with the alkaline earths in the second group of the M.A.Q.A. scheme. The careful adjustment of acidity before the addition of hydrogen sulphide would prevent the possibility of lead remaining in solution *after* treatment with H_2S, although experience has shown that lead is seldom carried through to this group.

The presence of the organic acid should be indicated by the usual preliminary tests, and attention can then be given to the possibility of removing the major part of the aromatic acids, benzoic and salicylic acids, if present, by treatment with dilute nitric acid before the precipitation of the silver-group metals, as recommended by the M.A.Q.A. scheme. The remainder of the organic acids is carried through to the same stage as above.

Tests on sodium salicylate itself showed that under the normally recommended conditions for removal of the organic acid picric acid is formed. These are the same conditions for the occurrence of the reactions in which salicylic acid is first nitrated in the 5-position with hot dilute nitric acid, and the resulting 5-nitrosalicylic acid is decarboxylated and further nitrated to yield picric acid on boiling with concentrated nitric acid[2]. The presence of picric acid at this stage is readily confirmed by spot test reactions[3]. The complete destruction of picric acid by evaporation with concentrated nitric acid is difficult to achieve; several additions of nitric acid are required and there may be several occasions during this process when a dry picrate residue is obtained.

However, when the M.A.Q.A. scheme is followed to the stage where the organic acids are removed by evaporation with nitric acid, the sulphuric acid added earlier as a group reagent for removal of the alkaline earths prevents the residue drying out too quickly, and in fact hastens the decomposition of the organic matter; after only one or two subsequent evaporations with nitric acid, no trace of organic material remains.

Although, in the M.A.Q.A. scheme as published at present, there is no real danger from the possible formation of picric acid, any future editions will recommend a preliminary evaporation to *fumes of sulphuric acid* at the stage where the organic acids are removed. Then the evaporation with nitric acid can be carried out without involving anything more hazardous than the use of concentrated nitric acid. This is, of course, only possible with schemes of analysis which involve the precipitation of the alkaline-earth metals at an earlier stage in the analysis, as is done in the M.A.Q.A. scheme.

We are grateful to Dr S. M. Farrar of Imperial Chemical Industries Ltd, Nobel Division, for pointing out this possible hazard in qualitative analysis.

W. I. STEPHEN,
The Midlands Association for Qualitative Analysis.

Chemistry Department,
The University,
Edgbaston,
Birmingham, 15.

1. Midlands Association for Qualitative Analysis. *Semimicro Inorganic Analysis, Advanced Tables*, 5th ed. Birmingham, 1959.
2. *cf.* H. T. Clarke, *Handbook of Organic Analysis*, 5th ed. London: Arnold & Co., 1954.
3. F. Feigl, *Spot Tests in Organic Analysis*, 5th ed. Amsterdam: Elsevier, 1956.

Obituary

Charles Edward Barrs. *B.* 13.10.1879. *Ed.* City of London College; Northampton Institute, London, 1898–1901. He became chief chemist to Locke, Lancaster & Co. in 1898, leaving in 1905 to take a post as analytical and metallurgical chemist to D. C. Griffiths & Co., where he remained until his retirement. (*A.* 1918, *F.* 1924). *D.* 25.6.60.

James Boyd. *B.* 1886. *Ed.* Royal Technical College, Glasgow, 1904–07. He remained at the College as assistant to Professor G. G. Henderson until 1911, when he emigrated to South Africa to accept the position of assistant chemist in the Goldfields Laboratory at Germiston. He served on the staff of the Miner's Phthisis Prevention Commission in 1913 and the following year he joined the Chamber of Mines. His long association with the Anglo-American Corporation began in 1926 on his appointment as secretary. He became assistant manager in 1935 and manager in 1952. At the time of his death he was a director of 25 of the leading South African mining and finance companies. He was one of the best known members of the Rand Club, being a member of the Committee for 25 years and chairman 1946–48. He was elected chairman of the National Development Foundation in 1951 and received the Coronation Medal in 1953. His long connection with the mining industry was to have been formally recognized the day after his death by the presentation of a Golden Jubilee Medal by the Chamber of Mines. 'James Boyd was one of those rare people who not only

hold distinguished positions with credit but make singular contributions to the human side of every sphere they enter. He did this without effort, with complete sincerity and in a highly individualistic way because kindness, generosity and friendliness were part of his character and not qualities that had to be cultivated.' (*A.* 1908, *F.* 1911.) *D.* 29.5.60.

Thomas William Cheke. *B.* 1885. *Ed.* Finsbury Technical College, 1901–04. He became an analyst to H. A. &. D. Taylor Ltd, Sawbridgeworth, Hertfordshire, in 1905, and was appointed research assistant to Mr M. Atkinson Adam, consultant, in 1912. He served in H.M. Forces 1914–16. For a short time he was a chemist in charge of acetone manufacture for the Ministry of Munitions, and in 1917 joined the British Dyestuffs Corporation Ltd (now Imperial Chemical Industries Ltd) as a research chemist. He took a similar appointment with the Rio Tinto Co. Ltd in London about 1926, and in 1940 was transferred to the copper refinery laboratory at Port Talbot, where he remained until his retirement in 1950. (*A.* 1905, *F.* 1921). *D.* 12.6.60.

Alfred Vincent Elsden. *B.* 20.4.1880. *Ed.* School of Science, Brighton; University College, London, 1898–1902. B.Sc. He continued at the College for a further two years as a research student and in 1904 took a post at the Royal Arsenal, Woolwich, as a junior assistant to the War Department Chemist, later succeeding him. He remained in Government service until his retirement in 1940, when he was Chief Chemical Inspector, Ministry of Supply. He was appointed M.B.E. in 1926, and some years later O.B.E. During his retirement he devoted much of his time to helping old people in distressed circumstances. (*A.* 1903, *F.* 1906; Council 1921–24, 1925–28). *D.* 15.7.60.

Lewis Goodin Spire Hebbs. *B.* 1.2.05. *Ed.* Ponders End Technical School; The Polytechnic, Regent Street, London, 1922–29. After a short period in the laboratory of Waterlow & Son, he joined the consulting practice of Cross and Bevan in 1922, and became a partner in 1930. He took over complete responsibility in 1938 and became the sole owner of the practice, remaining in control for the rest of his life. Throughout the Second World War he worked with the Ministry of Economic Warfare on Enemy Resources in the cellulose fields. Following the loss of Scandinavian sources of supply of pulp for nitro-cellulose, he went to America on behalf of the Director of Navy Contracts and the Research Department, Woolwich, to obtain cellulose for naval and rocket cordite. As a result, five mills were brought into production on grades not previously made in America. During 1945 he went to Germany as a D.S.I.R. nominee on the investigation of German pulp production for nitro-cellulose rayon and paper. (*A.* 1935, *F.* 1946.) *D.* 14.5.60.

Patrick Anderson Keiller. *B.* 8.11.1879. *Ed.* Dundee High School; University College, Dundee, 1898–1902. In 1902 he became the chief assistant of Mr (later Professor) James Hendrick in his work as Public Analyst for Aberdeenshire and neighbouring counties. He was appointed chief chemist to J. & J. Cunningham Ltd, Leith, in 1906. Two years later he left this country on his appointment as chief chemist and agricultural adviser to the Colombo Commercial Co. Ltd, Ceylon. He remained there until his retirement, when he returned to Scotland. (*F.* 1927). *D.* May, 1960.

Walter Gustav Leeman. *B.* 5.9.1897. *Ed.* Hospital Hill Government School, Johannesburg; University College, Johannesburg, 1917–21. M.Sc.Eng. (Witwatersrand), Dr.Ing. (Charlottenburg). He joined South African Railways and Harbours as a chemist in 1922, became a senior chemist in 1929, and was placed in charge of the laboratories in Pretoria and Cape Town in 1938. About 1957 he was appointed Professor of Metallurgy in the University of Pretoria, a post which he held for the rest of his life. He was the author of scientific papers. (*A.* 1933, *F.* 1946). *D.* 4.3.60.

Percy Lewis-Dale. *B.* 25.10.1877. *Ed.* Manchester School of Technology, 1900–07. B.Sc., Ph.D.(Lond.). He joined the London & North-Western Railway (which later became the London, Midland & Scottish Railway), and in 1920 was promoted to the post of chief chemist. In addition to his other duties, he acted in an advisory and consultative capacity in all chemical questions affecting any department of the railway. He retired in 1937. (*A.* 1920, *F.* 1923; Council 1930–33, 1936–39, 1940–42). *D.* 8.7.60.

James Herbert Oliver. *B.* 28.6.01. *Ed.* St. John's College, Southsea; Portsmouth Municipal College, 1916–20. B.Sc., Ph.D. (Lond.). He became an assistant analyst at the Olympia Agricultural Co. Ltd, Leamington Spa, in 1921. He attended the Royal College of Science, London, 1923–24, and in 1924 joined the consulting practice of Briant and Harman. He became a partner three years later and senior partner in 1944. He retained this position for the rest of his life. He was well known particularly in the field of brewing, and was the author, or joint author, of a number of scientific papers. 'His energy and enthusiasm were infectious, and he was ever ready to lay aside his own work to help others. He was a gracious and charming friend, and he will be sorely missed by all who had the good fortune to know him.' (*A.* 1923, *F.* 1945.) *D.* 1.6.60.

Eric Greve Strom. *B.* 27.9.21. *Ed.* Melbourne High School; University of Melbourne, 1939–41. B.A., B.Sc. He served as a Flight Lieutenant in the R.A.A.F., 1942–45, and was awarded the D.F.C. After a refresher course at Dyson Perrins Laboratory, Oxford,

he became a research chemist at the Anglo-Iranian Oil Co. Ltd (now the British Petroleum Co. Ltd) in 1946. Some years later he returned to Australia to take a post as technical officer to the Shell Co. of Australia Ltd. (*A.* 1946.) *D.* 2.2.60.

Norman Taylor. *B.* 2.8.1885. *Ed.* University of Manchester, 1904–07; Eidgenössiches Politechnikum, Zürich, 1908–11. B.Sc.(Manc.). He joined Nobel's Explosives Co. Ltd (now Imperial Chemical Industries Ltd) as a research chemist in 1911. He remained there until 1922, when he took a post at the British South Africa Co. Ltd, one of the original constituents of African Explosives & Chemical Industries Ltd. He became factory manager at Nobel (Australasia) Pty Ltd in 1927, and two years later, when the factory of Leathercloth Pty Ltd went into production, he assumed control of both plants. He was made a director of ICIANZ in 1935, and managing director in 1946. He retired the following year, and thereafter lived at Longford, Tasmania. As a young man he played county hockey and international ice hockey. (*F.* 1918). *D.* 15.2.60.

Peter Whelan. *B.* 14.2.1890. *Ed.* Municipal Technical Institute, Cork; Royal College of Science for Ireland, 1913–17. He continued at the College as a research student and in 1919 was appointed a demonstrator. Shortly after he became an assistant analyst in the State Laboratory, Agricultural Section, Dublin. He was later promoted to superintending chemist and finally assistant state chemist. (*A.* 1920.) *D.* 12.4.60.

Bertrand Ernest Wilde. *B.* 30.6.17. *Ed.* College of Technology, Manchester, 1933–35; Royal Technical College, Salford, 1935–37; Stockport College, 1937–38; Royal Technical College, Glasgow, 1939–40. B.Sc. (Lond.). He joined the Geigy Colour Co. Ltd as a laboratory assistant in 1933, and took a similar post at J. Anderson & Co. (Colours) Ltd in 1938, becoming a research chemist in 1940. He left in 1946 on his appointment as a research chemist to Monsanto Chemicals Ltd. He remained there until the time of his death, when he was assistant research manager. (*A.* 1941, *F.* 1946.) *D.* 23.5.60.

THE REGISTER

DEATHS

Fellows

(P) LIZIUS, John Leonard, B.SC.(LOND.). Died 9 July, 1960, aged 67. *A.* 1918, *F.* 1948.

(OG) SINGH, Bawa Kartar, M.A., SC.D.(CANTAB.), SC.D. (DUBL.). Died 16 June, 1960, aged 74. *F.* 1921.

Associates

(P) COLES, Gordon, Lemuel, B.SC.(LOND.). Died 13 September, 1960, aged 58. *A.* 1925.

(Q) WENYON, Conrad Gallimore, M.A., B.SC. (ST AND.). Died 20 September, 1960, aged 68. *A.* 1921.

LOCAL SECTIONS DIARY

Sections are glad to welcome members of other Sections to their meetings and social functions, except when numbers are restricted, as for works visits. Those wishing to attend meetings outside their own area are advised to write to the Hon. Secretary of the Section concerned, as the Institute cannot accept responsibility for any alterations or cancellations. All times are p.m. except where otherwise stated. For key to Local Sections *see J.*, 346.

(A) **Aberdeen.** 8 Nov. 8. Some Current Research Interests in the Department of Chemistry, University of Birmingham. Prof. J. C. Robb. Robert Gordon's Technical College. Joint, C.S. and S.C.I.

(P) **Acton.** 3 Nov. 7. Non-aqueous Solvent Systems. Prof. C. C. Addison. Brunel College of Technology, Woodlands Road, W.3. Joint, College Chem. Soc.

(P) **Battersea.** 30 Nov. 7. Nitration and Nitrosation; A Contrast. Prof. Sir Christopher Ingold. College of Technology, Battersea Park Road, S.W.11. Joint, College Chem. Soc.

(R) **Bournemouth.** 17 Nov. 7.30. Rocket Propellents. Dr W. G. S. Parker. Municipal College. Joint, Inst. Pet.

(D) **Bristol.** 10 Nov. 5.15. A.G.M., followed by films. Senior Common Room, The University
—— 25 Nov. 7.30. Annual Dinner and Dance. College of Science and Technology, Ashley Down

(P) **Cambridge.** 18 Nov. 8.30. Gastronomic Chemistry. Dr A. McM. Taylor. University Chemical Laboratory, Lensfield Road. Joint, University Chem. Soc.

(EE) **Carlisle.** 4 Nov. 7.30. The Role of the Analyst in the Nuclear Power Programme. F. J. Woodman. Technical College, Victoria Place

(D) **Cheltenham.** 16 Nov. 7. Social Evening

(T) **Chester.** 4 Nov. 7.30. Annual Dinner. Blossoms Hotel

(O) —— 16 Nov. 7.30. The application of the Alkali Act. F. E. Ireland. Lecture Theatre, Grosvenor Museum. Joint, Inst. Pet.

(P) **Croydon.** 10 Nov. 7.30. Some Aspects of Chemotherapy. Dr H. J. Barber. Technical College, Fairfield

(P) **Dartford.** 28 Nov. 7.30. Chemical Aids to Crop Protection. G. L. Baldit. North-West Kent College of Technology, Miskin Road. Joint, Dartford and District Pharmaceutical Soc.

(FF) **Dundee.** 11 Nov. 7.15. Some Observations on Analytical Chemistry. Dr J. Haslam. Technical College

(J) **Edinburgh.** 17 Nov. 7.30. Polymerization in Aromatic Solids. Prof. G. M. Burnett. North British Hotel. Joint, C.S. and S.C.I.

(W) **Exeter.** 11 Nov. 5. The Scientific Organization of Chemical Inspection. E. W. S. Press. Washington-Singer Laboratories

(WW) **Falkirk.** 24 Nov. 7.30. Tariffs and Chemicals in Western Europe: Retrospect and Prospect. G. Brearley. Lea Park Rooms

(K) **Glasgow.** 11 Nov. 7.15. Addition Polymerization in Solution. Prof. G. M. Burnett. Royal College of Science and Technology, George Street

(L) **Halifax.** 11 Nov. 7.30. Scientific Film Meeting. Percival Whitley College of Further Education

(M) **Hull.** 26 Oct. 7.30. Brains Trust. Francis Reckitt Institute
—— 10 Nov. 8. Forensic Chemistry. Prof. F. G. Tryhorn. Central Police Station. Joint, Pharm. Soc.

(H) **Leicester.** 24 Nov. 7.30. Ionization in Flames. Dr T. M. Sugden. Leicester College of Technology. Joint, Scientific Soc. of College of Art and Technology

(O) **Liverpool.** 3 Nov. Ladies' Evening: Hair Condition and Beauty—Theory and Practice. J. B. Wilkinson

(P) **London.** 5 Nov. 6.15 for 7. Twelfth Annual Dinner and Dance. Bush House, Aldwych, W.C.2
—— 15 Nov. 6.30. Annual General Meeting. Shell Mex House, Strand, W.C.2

(X) **Middlesbrough.** 15 Nov. 8. Micro-organisms at Work. A. E. James. Constantine Technical College

(S) **Newcastle.** 23 Nov. 6.30. The Changing Face of Analytical Chemistry. H. N. Wilson. Chemistry Department, King's College

(E) **Newport.** 25 Nov. 7. Debate: The Application of the Scientific Method to Government would be Beneficial. College of Technology. Joint, S.C.I.

(G) **Norwich.** 17 Nov. 7.30. Ladies' Night. Cooking, Baking and Confectionery. Dr D. W. Kent-Jones. City College

(P) **Norwood.** 8 Nov. 7. Film Show. Technical College, Knight's Hill, West Norwood, S.E.27

(H) **Nottingham.** 1 Nov. 8. The Metal Uranates: A new Family o Complex Oxides. Dr J. S. Anderson. The University. Joint, C.S.

(SS) **Preston.** 17 Nov. 7.30. Solvent Extraction Processes for the separation of Irradiated Nuclear Fuels. B. F. Warner. Town Hall. Joint, S.C.I.

(EE) **Seascale.** 18 Nov. 8. Chemical Bases of Human Energy. Prof. H. Nicol. Windscale Club

(U) **Sheffield.** 1 Nov. 7. Direct Reduction of Iron Ore and its Future in Steelmaking. J. Mackenzie. BISRA Laboratories, Hoyle Street. Joint, Sheffield Metallurgical Assoc.
—— 24 Nov. 7.30. Polypeptide Chain Configurations in the Fibrous Proteins. Prof. W. T. Astbury. Chemistry Lecture Theatre, The University. Joint, C.S.

(R) **Southampton.** 4 Nov. 5. The Chemistry and Pharmacology of some Adrenaline Antagonists. Prof. N. B. Chapman. The University. Joint, University Chem. Soc.

(V) **Swansea.** 17 Nov. 6. Chemical Control of Plant Growth. Prof. R. L. Wain. Chemistry Department, University College. Joint, C.S.
—— 25 Nov. 6. Ladies' Night. Sherry. M. D. Corbett. Chemistry Department, University College

(P) **Walthamstow.** 23 Nov. 7. Nucleic Acids and Heredity. Prof. J. A. V. Butler. South-West Essex College of Technology, Forest Road, E.17. Joint, College Chem. Soc.

(P) **Woolwich.** 7 Nov. 7. Some Aspects of the Chemistry of Cancer. Dr W. Davies. Polytechnic, Thomas Street, S.E.18. Joint, Polytechnic Scientific Soc.

(T) **Wrexham.** 11 Nov. 7.30. Explosives in the Service of Man. Dr B. D. Shaw. Denbighshire Technical College. Joint, S.C.I.

Erratum.—The degrees of Om Prakash BHARGAVA (*see J.*, 308) should have read B.SC.(AGRA), M.SC.(LOND.), D.I.C.